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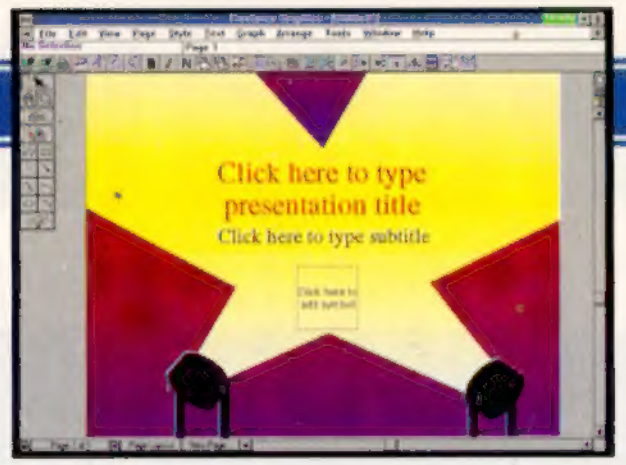
PC MAGAZINE

GRAPHICS

10 Presentation Programs to Help You Get Your Point Across



FREE UTILITY

WINPTR Makes Your Cursor Stand Out In Windows

COMMUNICATIONS

Fast, Fast Modems: We Test 10 That Communicate at 14,400 bps and Better

MARCH 17, 1992 THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOLUME 11 NUMBER 5

SERVER POWER

PC Labs Tests 22 486/33 Machines That Can Drive Your Business

SPEED UP WINDOWS!

13 Graphics Accelerators Run It Up to 10 Times as Fast

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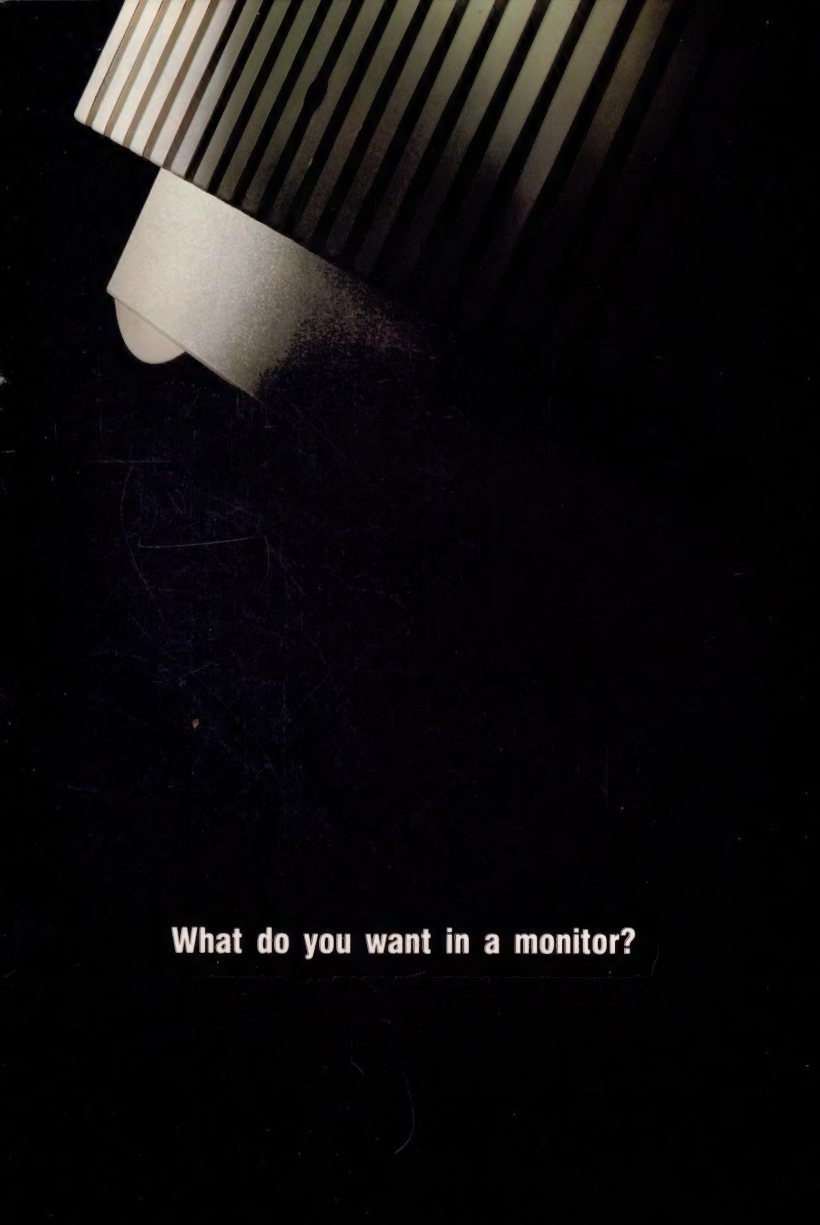
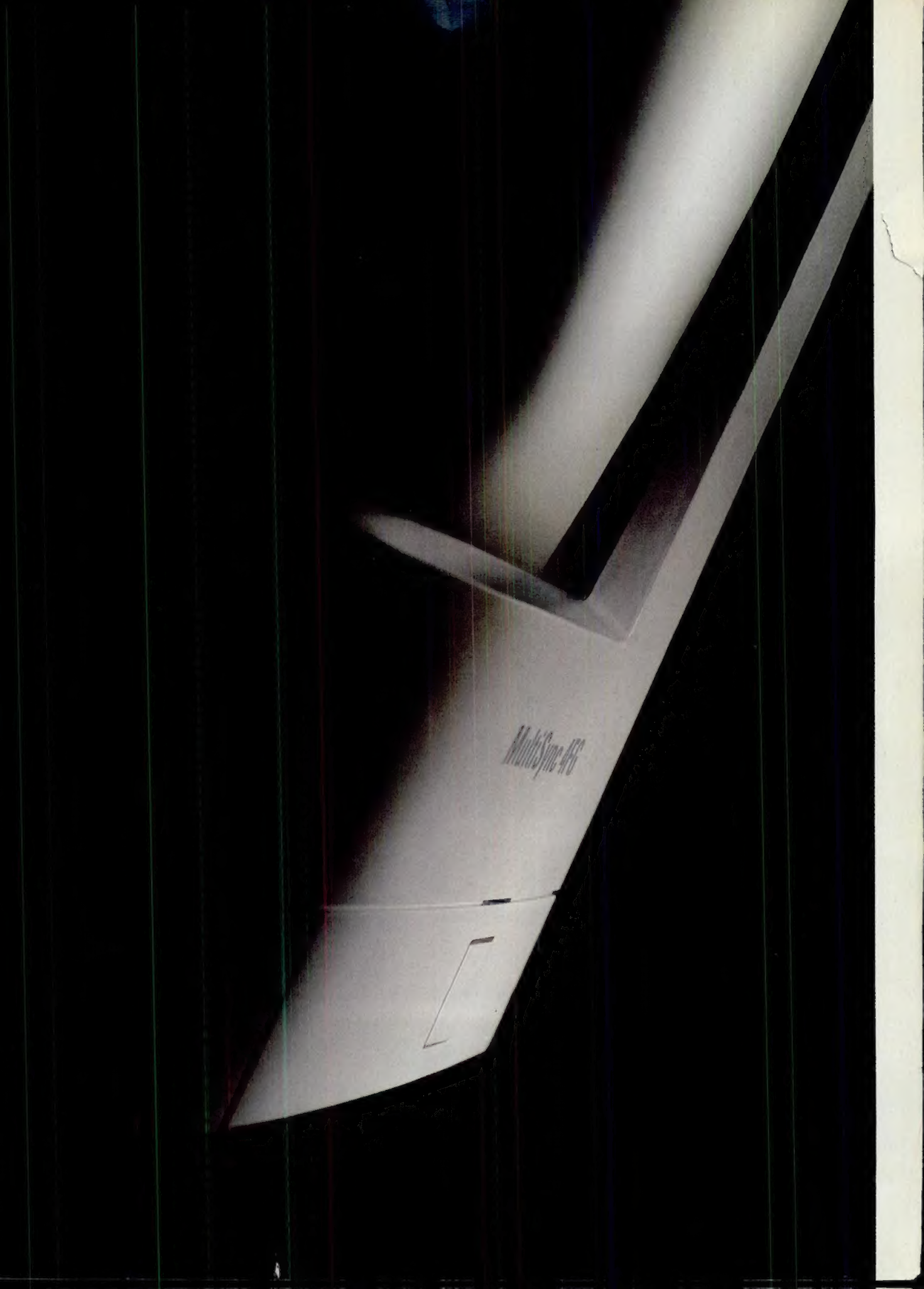
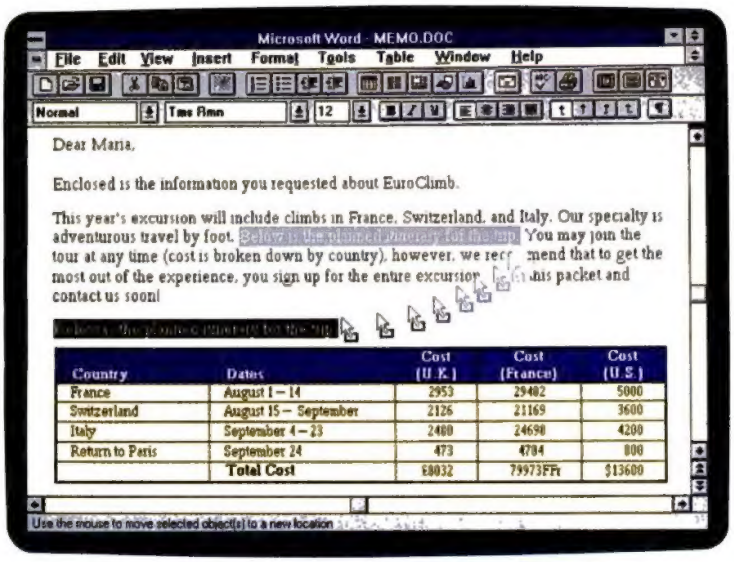

What do you want in a monitor?

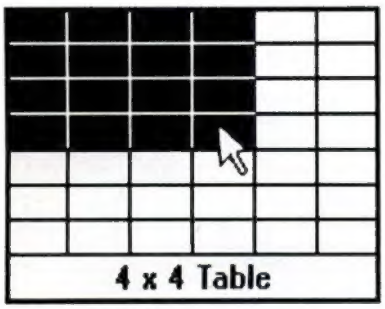

MultiSpec 456

The first wo
that works like

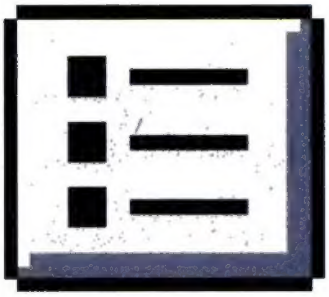
The Toolbar lets you do everyday things with the click of a button.



Rearranging a document couldn't be any easier.
With new Word 2.0 you can drag and drop text wherever you want.



All it takes is one click on the Toolbar and presto, instant tables.



Click this Toolbar button and get instant bullets.

The mouse makes everyday tasks as easy as click, click, click.

rd processor second nature.

Click here for automatic envelopes.

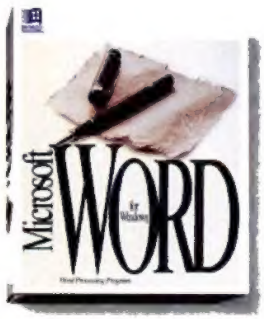
Click here to print your work.

Click here to make charts.

Click here to check spelling.

Click here to zoom in.

Introducing new Word for Windows 2.0.



When it comes to word processing, really nothing could be more natural than using the all-new Microsoft® Word for Windows.™ You see, Word 2.0 makes those everyday word processing tasks remarkably easy.

Which means you can now concentrate on what you're actually doing. Rather than how you're actually going to do it.

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CIRCLE 144 ON READER SERVICE CARD

Inside

PC-based presentations have come a long way in a short time. "Two or three years ago, the only thing that people expected from presentation graphics software was charts—ways to present numbers. Now, people are using presentation packages to help sell ideas," says Edward Stevenson, the *PC Magazine* associate editor who guided this issue's review of presentation graphics software.

Stevenson, who has a Bachelor of Fine Arts degree from the University of Chicago, has followed the transition closely. In 1988, he coauthored *Get to the Point: How to Say What You Mean and Get What You Want*, with Karen Berg and Andrew Gilman (published by Bantam Books). Much of the book was geared toward helping people use the technology at hand to prepare visual materials. At the time, the predominant tools were a daisy wheel printer and a photocopier.

Associate editor Edward Stevenson uses the "Coppertone Rule" to judge good presentation images.

The basics behind a good presentation haven't changed: Keep it simple; say it twice. "We came up with the 'Coppertone Rule'—don't pack any more into a visual than you could read off a billboard as you're driving by at 40 miles per hour," says Stevenson.

The big difference between then and now is the tools. Today's presentation graphics programs provide a dizzying array of fonts and clip art, making it easy to craft the elements of a visual. They can print on a variety of media.

"If you're serious about presentations today, you'll be running Windows—and you'll have the kind of system Windows requires," Stevenson points out. "But if you only prepare an occasional presentation, there are still good DOS tools available."

We also paid close attention to ease of use. One of the biggest complaints about presentation graphics packages is that they're too complicated. The packages that fared best in this roundup were also the easiest to use.

If you're looking at network performance, you'll need to read the roundup of 22 servers. All of these machines are 33 MHz 486-based PCs; all except the IBM PS/2 Model 95 have EISA buses. And all of them are sold as *NetWare*-compatible LAN servers.

You'll find that there are some extreme differences in price, although we didn't see a strong difference in raw throughput. But if you're building a secure network and you'll be taking advantage of the disk mirroring and duplexing capabilities of *NetWare*, you should pay careful attention to the differences in disk configurations. Some of the machines are clearly better equipped to handle demands on heavy network traffic.—**Gus Venditto** ■

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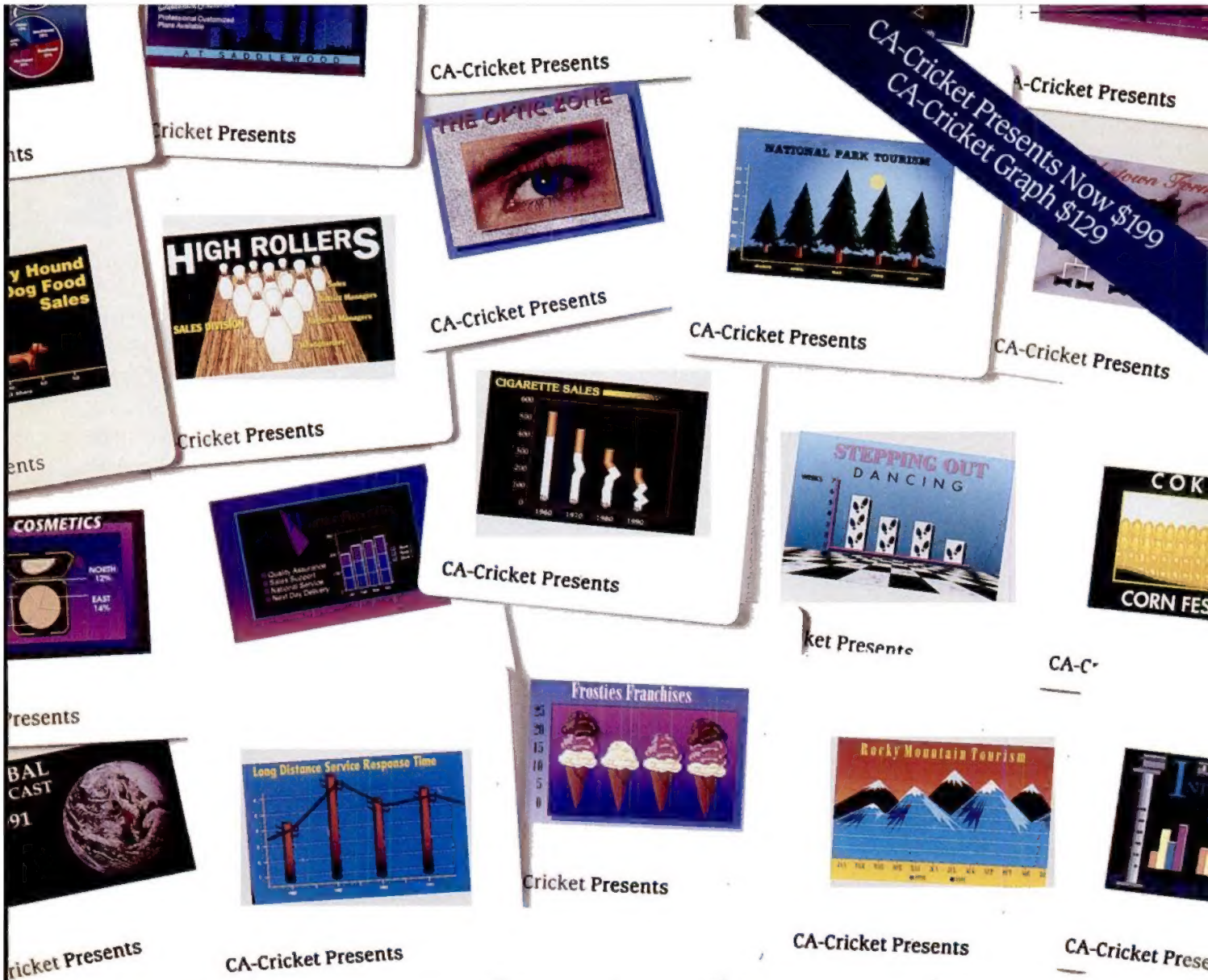

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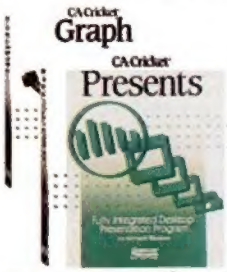

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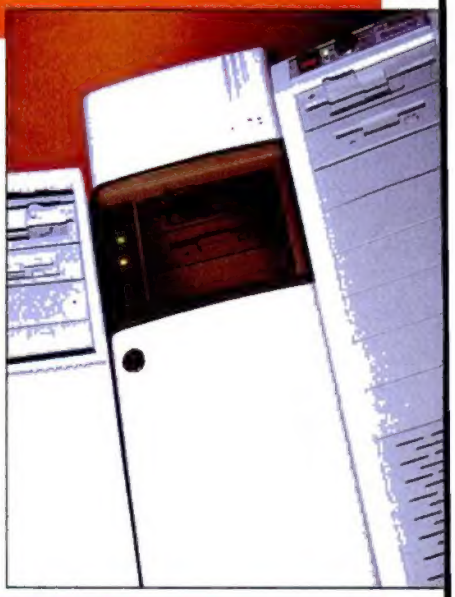

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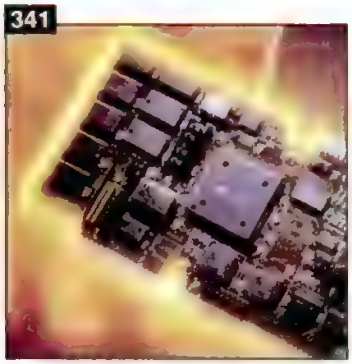

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Graphics Accelerators: Pump Up the Power
Alfred Poor/ If you want to speed up Windows, don't buy a new PC: Go with a graphics accelerator. Graphics accelerators will rev up GUI apps five to ten times as fast as vanilla VGA or Super VGA will, and many are under $500. PC Magazine Labs tests 13 of the latest.

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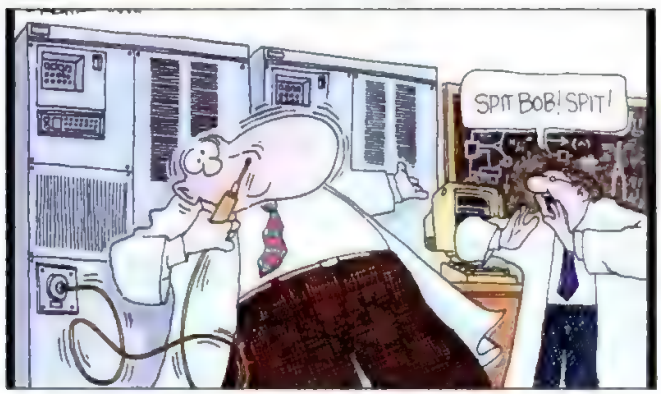

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February 11, 1992

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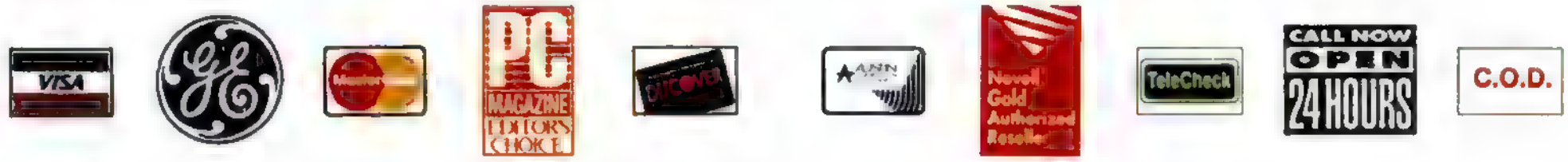

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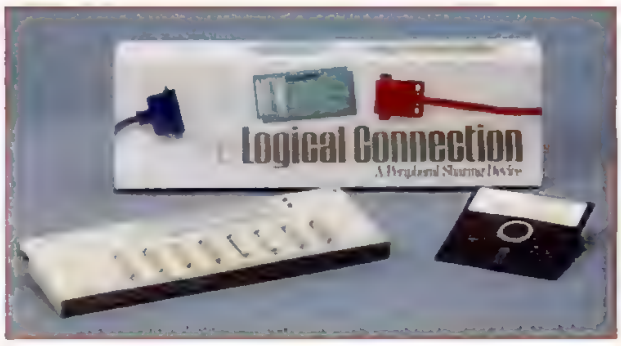
6 PCs or Printers/Any Combination

Practicality *LC – 256Kb* $395

The original Logical Connection is still all the printer sharing device that most people need. The LC is ideal for printing of word processing and occasional graphics data. Its eight ports are: four bi-directional serial ports which can be set as input or output, two parallel inputs and two parallel outputs. Six users can share two parallel printers. The serial ports can also share modems.

6 PCs to 2 Printers (Typical)



Simplicity *LC Jr. – 256Kb* $239

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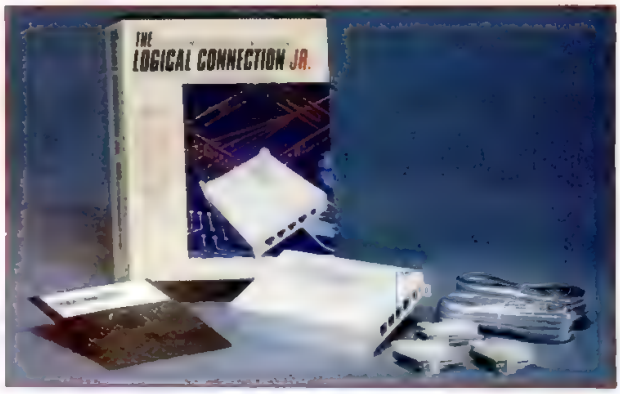
4 PCs to 1 Printer



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CIRCLE 131 ON READER SERVICE CARD

Letters

HARD DISK DILEMMA

The sidebar "Performance Tips: Trim Your Search Path" on page 314 of your "Choosing and Using Hard Disks" article in the December 31, 1991, issue is misleading. In writing about tree-structured directory systems, you claim that on a disk seek, "DOS will search the directories in your PATH statement first." The unsophisticated would assume that the PATH statement (in the environment) is consulted for all file accesses. Actually, the PATH is consulted last or not at all. The PATH statement is simply a list of directories to be searched when looking for a .COM, .EXE, or .BAT file to execute after a search of the current directory has failed. PATH is never consulted for a data file.

While I don't claim that I was damaged by your "slips of the pen" on familiar material, I don't read *PC Magazine* to learn what I already know. I have a friend who almost stole my copy of your magazine just to read the hard disk article. I am now recommending that he not read the misinformation.

Barry A. Mann
Philadelphia, Pennsylvania

Shame on Winn Rosch. Both CDs and Macintosh floppy disk drives perform reads and writes in what Seagate Technology terms zone bit recording. CDs change rotational speed (faster at the inner tracks, slower at the outer tracks), as do the Macintosh 400K and 800K floppy disk drives. In an article on hard disks, even though CDs (and CD-ROMs) and floppy disk drives don't fall into the category, let's not give out inaccurate information.

George Easter
Los Gatos, California

If what Winn Rosch says is true, it spells big trouble for many people. Most modern hard disks have a small on-board cache to reduce normal high-average seek times to a more acceptable level in the neighborhood of 15 milliseconds. Even this figure is too high for many users, so external caches are used to reduce it even further. A good hardware cache can reduce effective average seek time to 0.5 ms. or less.

Our hard disk feature prompted a flood of letters.

However, Rosch recommends against using an external cache with a hard disk that has an on-board cache. In fact, he even goes on to caution that using an external cache may actually slow down the effective average seek time. Does this mean we are forever limited to only what the manufacturer can provide? What's the story, *PC Magazine;* can we use external caches any more or not?

William D. Kraengel, Jr.
Valley Stream, New York

Certainly you can use external caches. In fact, we recommend a software cache in the sidebar "Performance Tips: Add a Disk Cache" on page 324. But we do not recommend mixing external and on-board caches, since these types of caches are not designed to act in concert, and they will cancel each other out if you use them at the same time.

If, however, your hard disk has an on-board buffer—not a cache—then investing in an external cache is worth your while. For an in-depth analysis of hard disk caching controllers, take a look at our February 25, 1992, hardware feature story on EISA ESDI controllers.—*Ed.*

Many thanks to Winn L. Rosch for his article on hard disks. It was thoroughly readable and understandable and did not get bogged down in technicalities. Let's see more of this type of article, please, for your readers who want to learn but who are not engineers or programmers.

Corey Field
Valley Forge, Pennsylvania

Nothing like creating and perpetuating a myth. In your hard disk glossary, you refer to a "Winchester" drive as having something to do with IBM's original PC hard disk. It had nothing to do with this. "Winchester" was the code name used by IBM when it was developing the drive technology for mainframes over two decades ago. The first production drive I remember using that had this technology was called a 3330-I. It was removable media and had a 100MB capacity—all the space I thought I would ever need.

Richard W. Dickinson
College Station, Texas

Please pass this on to Winn L. Rosch: Tsk, tsk, tsk! You should know that CDs use a linear velocity recording system rather than a constant angular velocity recording system. Otherwise, an excellent article.

Scott Lundahl
Moraga, California

Brickbats to the author of the sidebar "Performance Tips: Add a Disk Cache" in the recent hard disk article for using the phrase "free shareware"!

As a shareware author, I want to point out that shareware is not free. Shareware is software that may be freely copied but must be paid for to be used. The shareware industry depends on registration fees to allow it to develop more shareware. You

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CIRCLE 185 ON READER SERVICE CARD

owe it to your readers to make this clear, or at least to avoid misleading phraseology.

Scott Gourley
Watertown, Massachusetts

AUTOMATIC INSTALLATION BLUES

I entirely agree with William F. Zachmann's concerns ("Farewell to (Software) Innocence?," December 31, 1991) about software that must be automatically installed, often changing your AUTOEXEC.BAT or CONFIG.SYS files without proper warning as to what it has done to your files. As Zachmann points out, this can often mean that the new installation conflicts with other previously installed software, and it can be difficult to sort out exactly which piece of software did what.

Barring a good owners' manual, I've found a fairly simple solution, at least as far as the AUTOEXEC.BAT file goes. On my 386/33 system with a virtual drive for compressed files and a number of TSRs, my entire AUTOEXEC.BAT reads:

```
STARTUP
```

This invokes STARTUP.BAT, which contains the "real" commands.

The advantage is that when a new piece of software trifles with the AUTOEXEC.BAT file, it is easy for me to examine the file and see what has been added to my simple one-word command. I can then compare that with the specifications in STARTUP.BAT and make whatever changes are necessary. If my changes lead to conflicts, I can experiment by "REMing out" the new lines and testing them one at a time.

Steven Ledbetter
Newton Center, Massachusetts

I use a couple of safeguards in my system to prevent the installation of new software from screwing things up. One I learned from you. In your issue of June 9, 1987, you published a sidebar titled "Booting up with Bernie," which told how to modify COMMAND.COM to use a filename other than AUTOEXEC.BAT. I keep a sacrificial generic AUTOEXEC.BAT on my root directory, but my machine boots from another file on another directory. This makes it difficult to screw things up.

Robert H. Biles
Anaheim, California

I am delighted to see that there are others who object to the blind installation of software on their machines. I make sure I am fully backed up and have my AUTOEXEC.BAT and CONFIG.SYS files set as "read only" prior to installing any software.

There are far too few programs that tell you, either in print or during installation, just how their software will change your existing configuration. Fewer still pause to ask permission. And many packages, once given the okay to install, pour their entire guts into your machine, wasting valuable disk space. Often it is very hard to determine what portions can be removed and which cannot. If only more manufacturers allowed you to install only what you needed.

> Loyalty to one computer system as though it were the only acceptable ideology is ridiculous.

Dave Ussell
San Diego, California

INK FROM (AND FOR) OUR READERS

In response to Gwyn Magaditsch's letter in the December 31, 1991, issue: Magaditsch wanted to know about recycling printer ribbons. We (BSM Consulting, 41 F. St., Edwards, CA 93523; 805-258-9297) provide a service that re-inks fabric ribbons for printers and cash registers. The ribbons can be re-inked many times. When the ribbon becomes worn out, it can be replaced using the same cartridge. Also, the cost of re-inking is much less than that of purchasing a new ribbon.

Marc and Julia Creech
BSM Consulting
Edwards, California

This is in reply to a letter sent by Gwyn Magaditsch. I have found a company by the name of Preferred Data Supply that says it can recycle old printer ribbons: Preferred Data Supply, 3075 N. 75th St., Boulder, CO 80301; 800-443-9343.

Rich Voyek
Des Moines, Iowa

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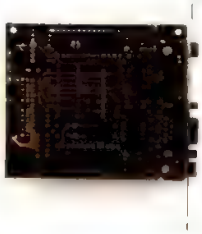

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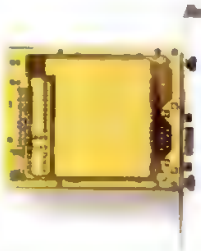
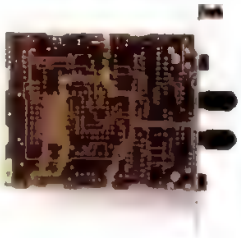


4/16 Mbps Selectable Twisted Pair RIM



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CIRCLE 389 ON READER SERVICE CARD

Letters

I'm writing in reference to "APO in Limbo" (Letters, October 29, 1991). People who live outside the United States and do not have a U.S. billing address can *not* get a calling card from AT&T. Therefore, I still cannot gain access to any 800 phone numbers.

Lindsay Allen
Canberra, Australia

AMIGA ATTITUDE

When I read John C. Dvorak's comment about Amiga users that said "most of them are pretty rude," (Letters, December 17, 1991) I couldn't help but feel that he was pretty much on the mark. Dvorak probably got that impression because the most vocal members of the Amiga community scream out against other platforms because they are insecure about their purchase and fear the demise of the market. As an Amiga owner and user group member, I have encountered this "Amiga only" attitude frequently. I may be a proud Amiga owner, but I wouldn't try to sell you one.

Loyalty to one computer system as though it were the only acceptable ideology is ridiculous in this day and age. I work frequently with both MS-DOS and Macintosh computers and think very highly of both platforms. I enjoy using my Amiga, but I won't throw myself off the nearest bridge when the market is fully extinguished. Computers are, after all, just machines.

David Mitchell
Overland Park, Kansas

I am puzzled by what Mr. Dvorak says he meant to write: "Many of you recall the DRI attempt at a Windows-like OS—the decrepit but interesting *GEM*-like operating system used in the Amiga..." Now, he may get away with the claim that AmigaDOS is *GEM*-like (he apparently is unfamiliar with Version 2.0), but it's still not clear to me what connection Digital Research has to the Amiga. Is it correct to say that Mr. Dvorak is the author of the *Inside Track*-like column?

Dr. Gerald Hull
Binghamton, New York

ARE YOU LISTENING, BILL GATES?

I just received your December 31, 1991, issue. I turned to the Utilities section first, as always. I read about WINNAV and immediately dialed in and downloaded the file. Outstanding! After five minutes, I knew that I had a winner. Why couldn't Microsoft have written File Manager the same way? WINNAV is the simplest, most user-friendly file manager for Windows that I have used. Doug Boling is to be congratulated for a first-rate utility. You made my subscription to *PC Magazine* worthwhile for the next couple of years with a single utility. Keep up the fine work.

Larry J. Scurlock
Washington, DC

PLEA TO ZACHMANN

Can Will Zachmann be enticed to comment on his predictions for 1991 *before* making predictions for 1992?

Dudley C. Smith
Ashburn, Virginia

CORRECTIONS & AMPLIFICATIONS

In the review of low-cost 2-D CAD packages (December 17, 1991), *Draft Choice* should have been listed as compatible with 8088-based machines. Also, in the benchmark tests on page 258, the test results for *Draft Choice* and *FastCAD* were switched.

"Choosing and Using Hard Disks" (December 31, 1991) states that compact audio disks operate at a constant angular velocity. It should have stated that they operate at a constant linear velocity. Also, the definition of "platter" (glossary, page 316) reports that on multiple-platter drives, one side of each platter is reserved for storing control information. It should have stated that just one platter on multiple-platter drives is reserved for this type of storage. And the "Performance Tips: Use DOS FAST-OPEN" sidebar on page 331 states that the DOS FASTOPEN command appeared in DOS 3.0; it should have read DOS 3.3.

HOW TO WRITE TO PC MAGAZINE

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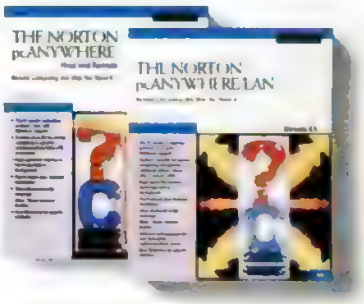

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CIRCLE 344 ON READER SERVICE CARD

Trends

Trends & Technology Shaping the Personal Computer Market

Microsoft Insists LAN Manager Lives On Despite Windows NT

When Microsoft bundled *LAN Manager* and Windows NT into the same development group, customers worried that Microsoft had put the OS/2-based network operating system out to pasture.

"Is *LAN Man* dead? Absolutely not," says senior product manager David Thacher. *LAN Manager* will live on to handle the more complicated server operations, with future versions planned for OS/2, Unix, VMS, and, of course, Windows NT, Microsoft's 32-bit operating system that will ship later this year. But Microsoft is also building networking services (such as peer-to-peer communications) into Windows products, hoping to loosen the grip Novell has on the booming network operating systems market.

Microsoft's networking strategy has grown increasingly aggressive since the company began selling *LAN Manager* directly to resellers in 1990. To date, the Microsoft version of *LAN Manager* has garnered only 2 percent of the network operating systems market, according to InfoCorp. But if you include systems based on *LAN Manager* from AT&T/NCR, Digital Equipment Corp., IBM, and 3Com, it holds nearly 13 percent of the 1991 installed base. That puts Microsoft in second place but still far behind Novell, whose *NetWare* operating system holds 50 percent of the market.

NetWare got a boost from Microsoft's former partner, IBM, when IBM began selling *NetWare* as well as IBM's *LAN Server*, which is based on Microsoft's *LAN Manager*. And even Microsoft recognizes the importance of Novell's installed

CONTINUES ON PAGE 32

Windows Development: Three Groups

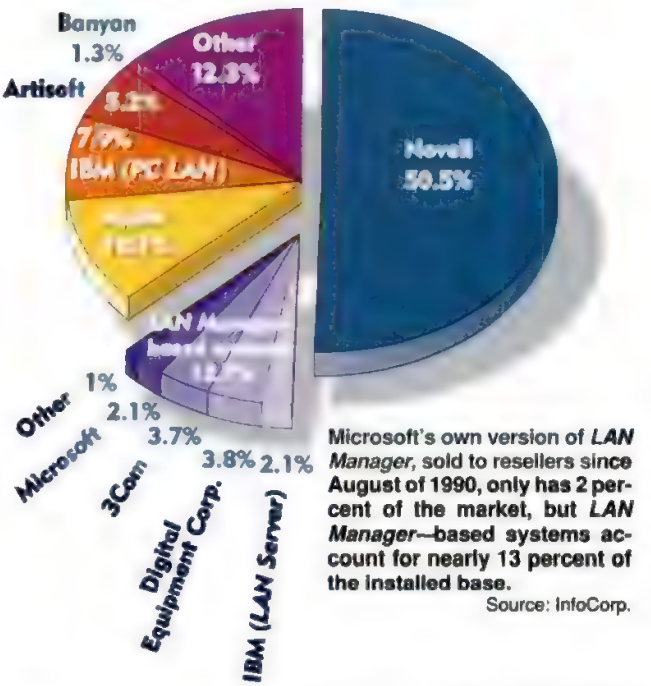
Personal Systems
Products: MS-DOS, Microsoft Windows
Vice president: Brad Silverberg

Corporate and Network Systems
Products: Microsoft's *LAN Manager*, Windows NT, SQL Server, DCA/Microsoft Communications Server
Vice president: Paul Maritz

Advanced Systems
Projects: Global naming system, Windows user interface, new storage system, object-based applications environment
Vice president: Jim Allchin

Two days after shipping *LAN Manager* 2.1, Microsoft reshuffled its Windows development team, bundling *LAN Man* and Windows NT into the same group.

1991 Installed Base of LAN Operating Systems



Microsoft's own version of *LAN Manager*, sold to resellers since August of 1990, only has 2 percent of the market, but *LAN Manager*—based systems account for nearly 13 percent of the installed base.

Source: InfoCorp.

Banyan Has What the Others Don't

Banyan's *VINES* may have only 1.3 percent of the network operating systems market, but the package boasts one feature neither Microsoft's *LAN Manager* nor Novell's *NetWare* has today: a global naming system, which acts like a telephone book for networks.

VINES was designed for large workgroups of 40 to 50 users in environments that include wide-area networks as well as LANs; *LAN Manager* and *NetWare* were originally created for workgroups of 10 to 20 people. *VINES'* StreetTalk Directory Assistance lets network managers get a list of users that are hooked up to all the servers on a company-wide network—something you can't do yet with *LAN Man* or *NetWare*.

Microsoft's global naming system is planned for Windows NT. *NetWare* users will get a global naming system in the soon-to-arrive *NetWare* 3.2.

—*Mary Kathleen Flynn*

Novell's Plan: To Stay No. 1

Half the installed base of network operating systems belongs to Novell, making it the undisputed market leader. Projecting a 40 percent growth in sales this year, the company plans to build on the success of its *NetWare* operating system and attack the weaknesses at the very top and bottom of its product line. Here are the plans:

- Ship a system-fault-tolerant

CONTINUES ON PAGE 32

Pipeline

by Gus Venditto

Perfecting Software With Public's Help

In the software business, learning from your mistakes is more than a virtue, it's a necessity.

For Microsoft, DOS 4.0 was a significant learning opportunity. A variety of bugs and incompatibilities made it the only flop in a ten-year string of successes. Some people at Microsoft like to blame the company's former partner, IBM, but the fact is that DOS 4.0 was not adequately tested and shouldn't have been released. A few months after the initial release, DOS 4.01 fixed the worst of the problems, but in the meantime, DOS's reputation had been damaged. Many users "waited out" DOS 4.*x* entirely.

Of the 1,137 Windows users who answered PC MagNet's survey, 875 say they plan to upgrade to Windows 3.1.

DOS FROM THE GROUND UP

With all this pent-up demand for a better operating system, Microsoft could have rushed out a new release and hoped that the world would be willing to forget. Instead, the software giant put together a team that painstakingly built a better DOS from the ground up. It asked buyers at large companies and developers to suggest features.

When it was almost ready to release the product, Microsoft took a big risk. Instead of testing the nearly finished code within the company and among a small group of developers, Microsoft opened the test up to a large group, using a private CompuServe forum as the nexus.

Testing beta software is a sensitive issue for any large company. Beta copies give competitors an early look at your next product. You risk disseminating faulty code, and you add a new support burden for a product that isn't even on sale yet.

THOUSANDS OF BETA TESTERS

Microsoft opened the DOS 5.0 beta test to thousands of people and gave it more than a year. It was a resounding success. DOS 5.0 was one of the most problem-free operating system releases ever, even though it contained changes far more significant than anything seen in DOS 4.0.

Currently, Microsoft is repeating the cycle with Windows. Just as the DOS 5.0 beta test forum on CompuServe began to wind down last June, Microsoft started up a forum for testing Windows 3.1.

More than 12,000 people will take part in the new test program. Before it's over there will have been three major beta releases. The final beta version shipped in January, and the finished shrink-wrapped package is due in stores by April.

In past test programs, Microsoft had to make painful choices on who it could support. Typically, established software vendors had the edge. Now, with a broad-based beta, the circle of insiders is greatly widened. While there have always been programs to support small developers, the CompuServe forums increase the amount of information available to small developers. The little guys gain early access to new features; in Windows 3.1, that means the chance to write programs that support TrueType fonts, sound drivers, and the data-sharing utilities that are part of the Windows OLE (object linking and embedding) feature.

This is also a case of learning from past mistakes. When Microsoft charged $2,600 for access to OS/2's early code and development tools, it alienated hundreds of small developers. The development program for Windows is part of a campaign to win them back. Developers who paid for the OS/2 software developers' kit (SDK) recently were offered the chance to receive Windows development tools (the kit for developing 32-bit Windows programs) when it becomes available, with the newest versions of Microsoft's C and C++ thrown in.

IBM OPENS UP

The effort to woo small developers was prompted by competition from IBM, which has dropped all pretense of developing OS/2 in private. IBM is selling versions of OS/2 that it admits are in development, and it has started to offer the OS/2 2.0 development kit free to those who bought the original OS/2 kit from Microsoft.

IBM has also surpassed Microsoft in the degree it has gone public in discussing development of OS/2; for example, the head of IBM's development team, Lee Reiswig, has been answering questions about the next version on Prodigy. Soon after, Microsoft's chief Windows programmer, Brad Silverberg, began to chat with callers to the Windows CompuServe forum.

The beta test can generate some intense activity. In between the official air shipment of beta releases, Microsoft made it possible to download interim updates of the code. Hundreds of people took the opportunity, even though the data took up 7MB (in compressed form). Two weeks later, the same people were doing it again, when another minor upgrade became available.

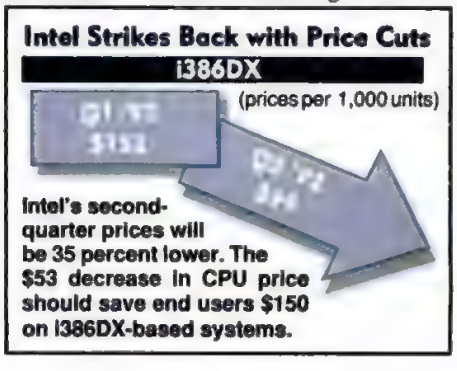
Right now, broad-based beta testing benefits all users, especially those who *don't* take part. But it's expensive—Microsoft shipped roughly a half-million disks to beta testers over the course of the program—and it's hard work for the thousands of users who participate. Beta testers don't get paid (in the Windows program, all they'll get is a free version of the final product), but they donate long hours to discovering incompatibilities, working around bugs, and demanding new features.

Microsoft is lucky to have them, and smart to ask them to do it. ■

More Chip Choices: IBM, C&T, and, Oh Yeah, Intel

Last year Intel didn't make enough 386 chips to meet the demand, which created an opportunity for Advanced Micro Devices to break Intel's stranglehold on the CPU market. Now other companies, including IBM and Chips and Technologies, are joining the market. By way of fighting back, Intel cut its prices by 35 percent.

But instead of stamping out only pin-for-pin Intel replacements as AMD did, these companies have promised increased functionality and higher performance along with full 386 compatibility. The extra pins, however, make for something of a Sword



Intel's second-quarter prices will be 35 percent lower. The $53 decrease in CPU price should save end users $150 on i386DX-based systems.

Multimedia: Looking For the Killer App

Most PC users agree that multimedia is fun—"cool," to use Bill Gates' signature adjective—but opinions vary widely on its usefulness. Some people believe that it will take a so-called killer application on the order of *VisiCalc*—the predecessor to *Lotus 1-2-3*—to show business customers the power of multimedia. So where is the killer app?

"Multimedia is not a market," says NeXT CEO Stephen Jobs. "The laser printer wasn't a market, but desktop publishing was. People are looking for the killer app. Is it training? Well, maybe."

Apple CEO John Sculley muses, "I love the technology, but nobody has figured out how to make any money on it. For the present, the biggest markets are training, education, and teleconferencing."

"As soon as you start talking about content," says Microsoft CEO Gates, "people have different interests. I don't see any title—except maybe the encyclopedia—with 30 to 40 percent market share." So what kind of application will convince business users of the benefits of multimedia? "Productivity apps," answers Gates.

"There is no killer app for multimedia," says Lotus CEO Jim Manzi. "Multimedia is a very important feature to put into other products. Right now it's just a toy, but it will be important." But asked what will make multimedia important to business users, Manzi says, "When products exist that use multimedia to help people do their jobs better." When will that be? "Sometime in the future."

—*Mary Kathleen Flynn*

Cirrus Chip Set Adds Voice to Fax and Data

Imagine a laptop computer you can leave in your hotel room, connected to the telephone, that will answer the phone and act as an answering machine if it hears a voice or as a fax machine if it gets a data stream.

In the second quarter, Cirrus Logic will ship to OEMs two voice/data/fax chip sets with power requirements and dimensions that make them ideal for laptops and pocket modems. Laptops with the new chips should arrive soon after.

Because the chip sets are complete implementations of the modem protocols, nearly all the OEM needs to do is mount them on a board. No special coding is required. And because the sets are so inexpensive, the chips will add little to the cost of the laptop.

The CL-MD1424AT is a two-chip set combining data, fax, and voice. The CL-MD1424EC adds a third device that incorporates state-of-the-art error control (both V.42 and MNP 4) and data compression (both V.42bis and MNP 5).

Both chip sets can send and receive fax at 14,400 bps and data at 2,400 bps. Both support CCITT V.22 and V.22bis standards in data mode, and V.17 (the newest, fastest fax standard), V.29, v.27ter and V.21 ch2 in fax mode, which are also EIA-578 Class 1 compatible. Additionally, these chip sets contain a 16C550A register-compatible UART for enhanced data throughput.—*Rick Ayre*

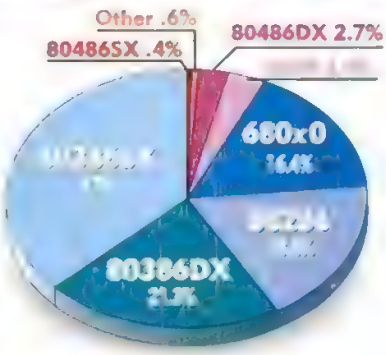
of Damocles: higher speeds, caches, and power management exact a tax of longer development times and nonstandard motherboard designs that could run the risk of alienating potential buyers.

IBM was the first to extend Intel's design under an agreement with Intel. IBM's 386SLC, planned for the PS/2 Model 57 and portables, is a 20-MHz 386 with an internal 8K cache and power-management features. The design specifications make it closer to an Intel 486 than an ordinary 386; in performance it's expected to be nearly equal to a 486SX.

Chips and Technologies' 386 attack is two-pronged: The company has a pin-for-pin 386 clone, the 38600, and an extended functionality chip, the 38605. Although C&T is currently sampling the chips to motherboard makers, no major OEMs have yet signed on to the C&T promise of 40 percent greater performance with the 38605. C&T said it expects to name a number of OEMs when production units of the microprocessor arrive in mid-1992.

Two dark horses in the CPU race are Cyrix and NexGen. Cyrix, maker of an 80387 math coprocessor, is reported to have a 386-compatible CPU in the works and is expected to announce it this spring. NexGen is developing a high-end CPU to compete against Intel's 50-MHz 486. When it's released later this year, NexGen's x86 chip, designed for multiprocessor operating systems, will be geared for applications like CAD and other high-end graphics tools that require blazing floating-point speeds.—*Christopher Barr*

Personal Computer Sales January to November, 1991



More 386SX-based systems are sold than any other kind, but 386DX-based PCs take second place.

Source: StoreBoard/Computer Intelligence

TOP 15 Software Sellers at Retail

RANK	COMPANY
1	**Quicken 5.0** Intuit
2	**QEMM-386 6.0** Quarterdeck Office Systems
3	**TurboTax Personal 1040** ChipSoft
4	**WordPerfect 5.1** WordPerfect Corp.
5	**DR DOS 6.0** Digital Research
6	**Microsoft Windows 3.0** Microsoft Corp.
7	**Quicken for Windows** Intuit
8	**Microsoft DOS 5.0 Upgrade** Microsoft Corp.
9	**Aml Pro 2.0 Upgrade** Lotus Development Corp.
10	**Stacker 2.0** Stac Electronics
11	**ProComm Plus 2.0** Datastorm Technologies
12	**Lotus 1-2-3 2.3** Lotus Development Corp.
13	**Report Writer** Clarion Software
14	**Norton Utilities 6.01** Symantec Corp.
15	**WordPerfect for Windows Tradeup** WordPerfect Corp.

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending January 4, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a complete picture of the entire software market.

Sales information compiled by Ingram-Micro

BRIEFS

■ **Computer pioneer Grace Murray Hopper, who helped invent COBOL, died on New Years' Day at the age of 85.** The retired Navy Rear Admiral worked on the Mark 1, the first large-scale digital computer. In 1991, Hopper received a National Medal of Technology for developing computer programming languages that simplified the technology. Since 1986, Hopper had worked as a computer consultant at Digital Equipment Corp.

■ **Microsoft CEO Bill Gates became the wealthiest person in the U.S. around the first of the year,** as Microsoft stock soared to record highs. The stock closed the first week of 1992 at $113—almost double its price of $64 a year earlier—and continued to climb. As the owner of 56.7 million shares, Gates is worth more than $6.4 billion. Neighbors in his native Seattle hope he'll spend $100 million of it to keep the struggling Mariners American League baseball team in the Pacific Northwest. But Microsoft spokesperson Marty Taucher doesn't think Gates will play White Knight: "Bill's already got a full-time job," he says.

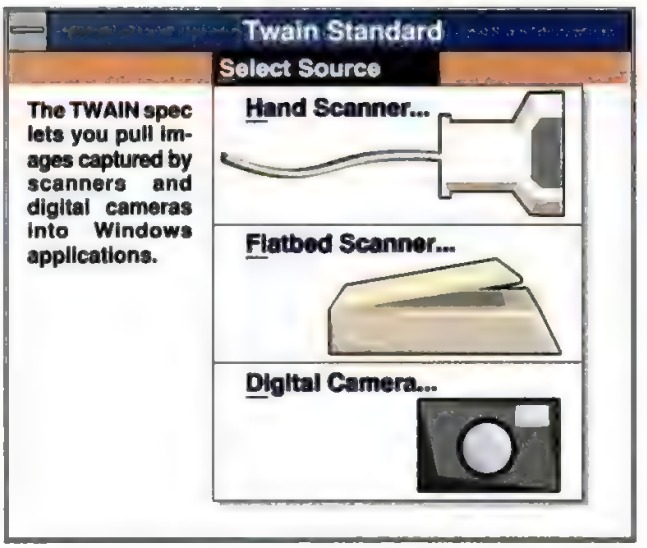
■ **The Multimedia PC Marketing Council has replaced the 10-MHz 286 with the 386SX as its base spec for the Multimedia PC.** As we reported in the January 14, 1992, issue of Trends, the Council began formally reviewing the spec last fall when it set up a technology committee. "It turns out that there's a larger installed base of 386SX machines than market research had indicated when the spec was first outlined in 1989," explains managing director Glenn Ochsenreiter. "We believe this is a more appropriate spec." The other specifications remain unchanged.

■ **OS/2 Update:** IBM says that OS/2 2.0 will support OLE between windows applications that use the feature, but Presentation Manager will not support it.

Getting the Right Image with TWAIN

From all over the image market, companies such as Aldus, Caere, Eastman-Kodak, Hewlett-Packard, and Logitech have come together to establish a standard for connecting image-capturing tools and applications.

The letters in TWAIN don't actually mean anything, but the standard does. TWAIN is an important application program interface (API) and protocol that will make it easier for you to incorporate into Windows and Macintosh applications images captured by scanners, frame grabbers, and digital cameras. The TWAIN specification takes care of how an application acquires the image, so that developers can focus their attention on making the underlying application better instead of writing drivers.



The TWAIN spec lets you pull images captured by scanners and digital cameras into Windows applications.

TWAIN's Source Manager is the universal core that negotiates between the application and the device. It's installed as a Windows DLL by the application and lets you choose the source of the image. Getting an image other than clip art will be as simple as clicking on "File," then on "Select Source," where you choose among the input devices you've installed, and then "Acquire Image." The application will then scan, grab, or load an image without requiring you to close what you're working on to load proprietary software each time you want another image.

Logitech's FotoTouch image-editing software is one of the first TWAIN-compliant products and comes bundled with the ScanMan Model 256 hand scanner. A future version of Caere's OmniPro OCR software will also use TWAIN. Because TWAIN is a common protocol, you'll be able to use both products with any TWAIN-compliant image-capture hardware, which is expected to start coming out in mid-'92.

—Christopher Barr

LAN Man Plans

CONTINUED FROM PAGE 29

base; one of the most touted features of *LAN Manager* 2.1 is the ability to hook up to a *NetWare* server and a *LAN Man* server at the same time (see First Looks, February 25, 1992).

Microsoft argues that its key selling point against *NetWare* is its focus on Windows. The new Remote Access Service option for *LAN Manager* 2.1, for example, lets users dial into the network from a Windows front end, something neither *NetWare* nor *VINES* can do, according to Thacher.

By building networking into Windows, Microsoft is competing with Novell's *NetWare Lite* and Artisoft's *LANtastic* for a share in the fast-growing low-end segment of the market. Unlike Novell and Artisoft, however, Microsoft is not planning to develop a separate product aimed at small businesses. "There is no *LAN Man Lite*, so to speak," says Thacher.

Going after Novell is certainly an ambitious undertaking, but with 7 million copies of Windows in circulation, Microsoft just may have the clout to do it.—*Mary Kathleen Flynn*

Novell's Strategy

CONTINUED FROM PAGE 29

(SFT) version of *NetWare* (probably late in 1992) and follow up with a version of *NetWare* that takes advantage of multiple processors.

■ Add management, database, and communications capabilities to *NetWare* 3.*x* through its highly efficient *NetWare* Loadable Modules (NLMs). This should entice *NetWare* 2.2 users to upgrade to the more capable, more profitable 3.*x* version. One example: a communications server NLM (still in beta) that can be used in the same box as the *NetWare* file server, rather than requiring a separate dedicated PC.

■ Add a global naming service (finally) in *NetWare* 3.2, which is due shortly. Global naming gives a user hassle-free access to any resource on the network, regardless of whether the use is 5 feet or 5,000 miles away from the resource.

■ Build on the surprising success of *NetWare Lite* (200,000 plus copies shipped the first three months) and get busy fixing such glitches as poor Windows support, mediocre speed, no e-mail, and copy protection. Low-cost LANs, such as Artisoft's *LANtastic* and *NetWare Lite*, account for a fifth of all LAN sales today, according to Novell.

■ Possibly make a future version of DR DOS (acquired last year) able to handle simple networking on its own (as Apple does and future versions of MS-DOS and Windows will), without needing the services of a network operating system like *NetWare Lite* or *NetWare*.

—Bill Howard ■

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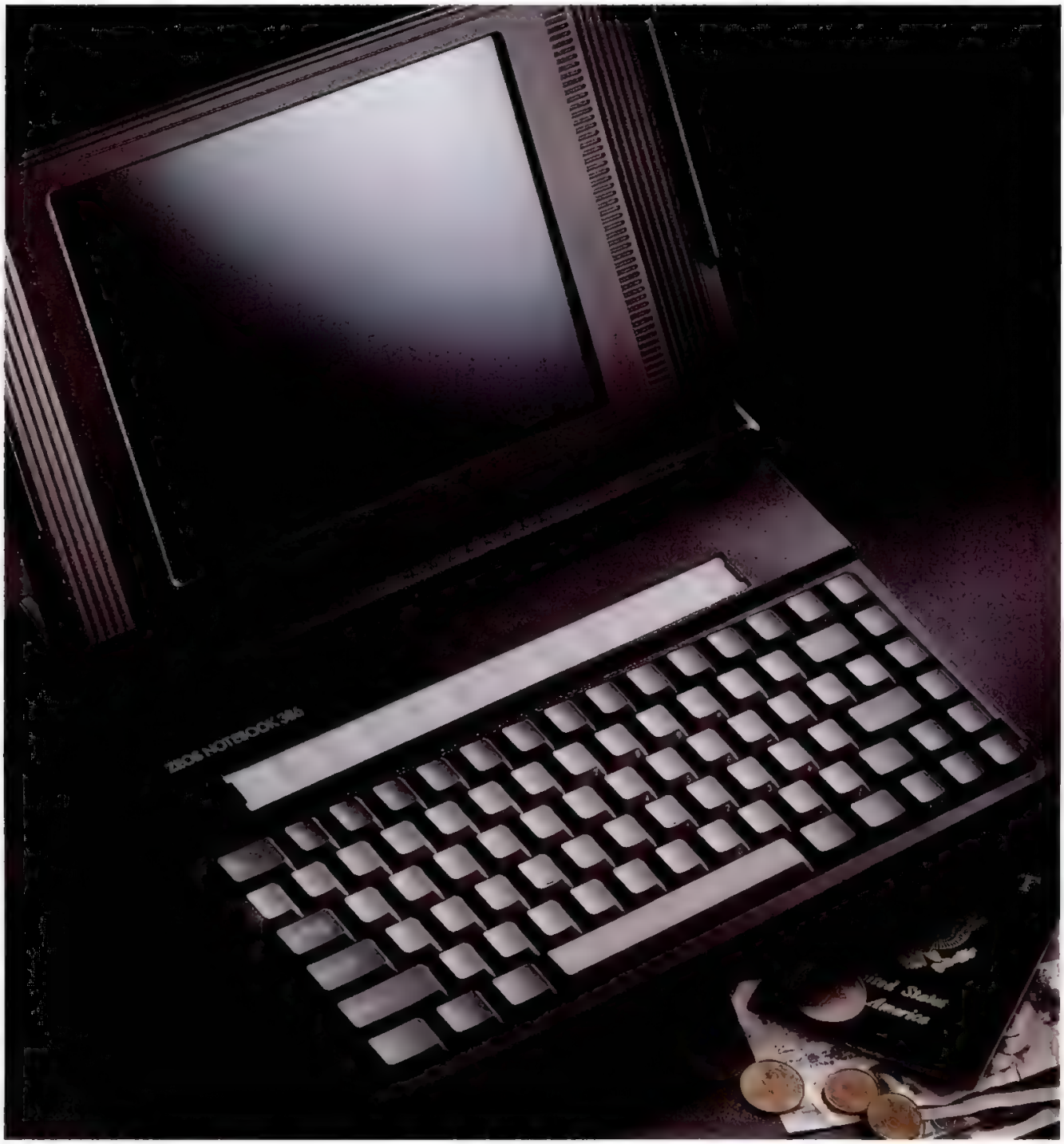

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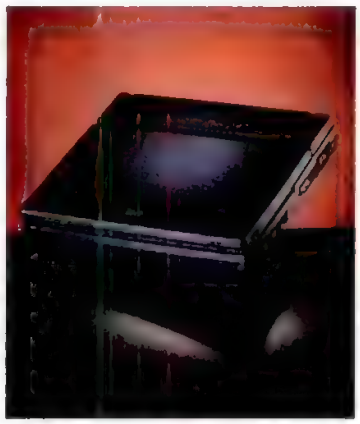

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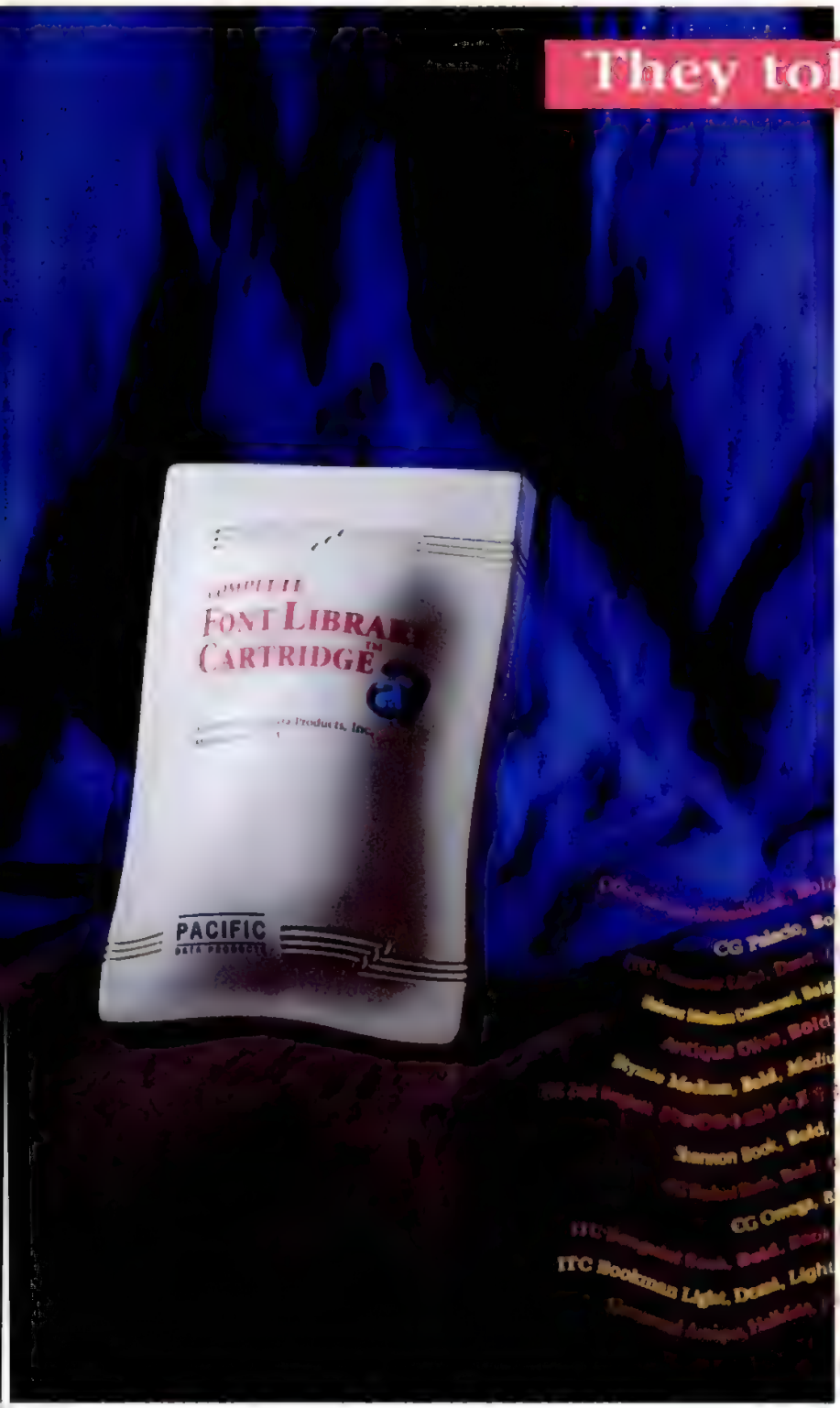

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First Looks

Hands-on Reviews of the Latest Products

WinJet/800 Brings 800-dpi PostScript to Your LaserJet

HANDS ON
by Edward Henderson

You can buy the WinJet/800 board (front) by itself for $995, or as part of the WinPrinter/800 for a total price of $2,195.

If you use Windows, a LaserJet, and a fast computer, LaserMaster's $995 WinJet/800 expansion board will convert your printer into the fastest and finest PostScript printer available on a desktop (in fact, it's this issue's New and Improved Hot Prospect). If you don't have a LaserJet, the $2,195 WinPrinter/800 provides a similar expansion board, a printer to use it with, and software that adds LaserJet II emulation to the PostScript features of the WinJet/800.

Both the WinJet/800 and the WinPrinter/800 print at 300 and 800 dpi. The WinJet works with the LaserJet II, IID, III, and IIID; you can't use the IIP or IIIP, which lack video I/O ports. The printer that comes with the WinPrinter package works only with the board and can't be used without the accompanying software. The WinJet/800—the one that works with the LaserJet—is the one you care about.

Like other add-on controller boards (including LaserMaster's expensive Series III Professional), the WinJet adds speed and resolution to the printer on your desk without interfering with its native functions. Unlike most other add-on boards, it requires no special DOS drivers that eat up RAM. It gets its speed from its use of your computer's CPU instead of the slow processor in the printer; the faster your computer, the faster it prints.

Using Windows' Enhanced mode, the WinJet (and the board that comes with the WinPrinter models) processes data in the background while you work with applications in the foreground. You can get 800-dpi PostScript from DOS applications if you run them under Windows, and you can install the WinJet in a network server and let remote computers use it transparently.

The WinJet software uses LaserMaster's improved version of Microsoft's TrueImage PostScript interpreter. It speeds through files that the combination of the LaserJet III and the HP PostScript cartridge can't print at

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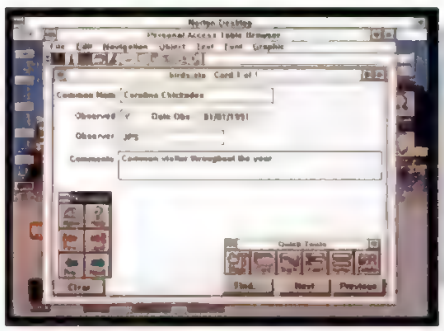
Personal Access: A Hypermedia Front End For Easy Data Retrieval

HANDS ON
by Joe Salemi



***Personal Access* uses a number of toolkits to assist you in quickly creating and manipulating hypermedia card stacks from existing databases.**

PC users first became aware of the concept of hypermedia when Apple released *HyperCard* for Macintosh systems. Since that time, a number of vendors have released *HyperCard*-like applications for the IBM PC world. The latest entry in this growing field is *Personal Access* from Spinnaker Software, a Windows 3.0 hypermedia application that extends the concept to user-oriented database access.

The heart of *Personal Access* is Spinnaker's *PLUS*, a hypermedia applications development and management system that comes in both Macintosh and IBM versions. *PLUS* is object-oriented, and lets the user create stacks of "cards," which can contain data objects such as text fields, graphics, and control buttons. Cards are created by placing various objects on either the foreground (present only on the visible card) or background (present on all cards in the same stack); the objects are designed and placed using the *PLUS* toolbox menu.

The point-and-shoot and drawing capabilities of Windows' GUI are fully supported when designing and using cards, and graphics objects can be imported from such drawing packages as *Adobe Illustrator*, *CorelDRAW*, and *Windows Paint*.

Underlying the control objects in a *PLUS* stack are scripts written in PPL, the *PLUS* Programming Language. PPL is event-

CONTINUES ON PAGE 40

Two Presentation Packages Bring Multimedia to the Masses for Under $200

HANDS ON
By Peter Scott

Multimedia business presentations are still a novelty, but a growing interest in creating presentations with special effects has led several companies to launch products into this unexplored territory. Two recent arrivals, *Madison Ave.* and *Curtain Call*, provide simple and effective ways to spice up business presentations.

Neither of these programs is a replacement for traditional presentation graphics packages such as *Harvard Graphics* or *Aldus Persuasion*, which specialize in business charting and graphing. Rather, each program offers straightforward tools for producing desktop presentations with sound effects and voice narration and can prove especially useful in developing low-cost demos, exhibition displays, and training productions.

MADISON AVE. FOR DOS

Madison Ave. from Eclipse Technologies, the simpler of the two, is a $169.95 DOS-based program that employs a slide-show metaphor. For each slide in the "carousel," you may define a picture, a voice file, a sound file, and a pointer file (a record of the pointer as it moves across the screen). Once you have all of your slides in place, you can run your show from start to finish, producing a disk-based video presentation.

The program's Spartan interface offers easy access to the three main elements of a *Madison Ave.* presentation: the Camera, the Recorder, and the Show Player. To construct a presentation, you link all three of these elements together. And to enhance your presentation, you can apply special effects such as wipes, fades, and dissolves, and control pacing with preset delays.

Before you can build a *Madison Ave.* presentation, you will need to design all of the screens you plan to use. There are no facilities for drawing graphics, for creating charts, or even for writing titles. All of your designs and text must be created with a separate program, which means that you'll have to couple *Madison Ave.* with your traditional business graphics program. At the very least, you'll need a paint program for creating title screens. You can use your spreadsheet program for creating charts.

***Madison Ave.*'s Camera is a memory-resident utility that snaps .PCX shots from DOS and Windows applications. You construct presentations by arranging files in the Slide Carousel and applying transition effects.**

You import the raw material with *Madison Ave.*'s Camera utility, a memory-resident program that captures .PCX format graphics files. However, this utility is not completely compatible with all .PCX files. The resolution of the image must be 640 by 480. Otherwise, the program will display an "Error loading file" message.

Likewise, the program's Recorder, which captures voice, music, and sound effects, is incompatible with some types of files. It's adequate for recording simple voice narration, but does not import .VOC files (digitized voice files created with the Sound Blaster or Sound Blaster Pro card) created in other applications, or even files that ship with the Sound Blaster board. A toll-free call to Eclipse Technologies' technical support line revealed that the incompatibility is related to header information contained in each .VOC. It's possible to edit this information, but that's not a job you want to tackle when you're creating a presentation.

To control the pace of your presentation, you assign one of several "delay" attributes to a slide. You might, for example, keep the slide on the screen until the sound file is finished playing or for a set number of seconds. You can also create continuous narration to cover a range of slides. This kind of presentation can be very useful for exhibits. For a training presentation, you can set the delay to wait for a mouse click or keystroke.

Unfortunately, *Madison Ave.* is not able to output slides or overheads. Registered users can receive a runtime version which enables them to distribute presentations on floppy disks. Keep in mind that if you incorporate voice or sound, the computer that runs the presentation must be equipped with a compatible sound card; the program supports Ad Lib, Sound Blaster, and Thunder Board, as well as many others.

Madison Ave.'s strengths lie in its simple interface, which makes it possible to create presentations quickly and with little knowledge of sound and voice files—new territory to most business users. But its lack of editing and design tools and incompatibility with standard file formats limits its usefulness to only the most basic presentations.

This *Madison Ave.* slide displays a scanned photo showing planetary orbits; the title was added with *Tempra GIF*. For impact, a .VOC sound file plays in the background.

CURTAIN CALL FOR WINDOWS

Curtain Call, $199.95 from Zuma Group, offers most of the editing and control features that *Madison Ave.* lacks. As a Windows-based program, it also offers the

CONTINUES ON PAGE 39

Multimedia

CONTINUED FROM PAGE 38

benefit of supporting a variety of graphics formats (.BMP, .DIB, .PCX, .RLE, and the program's own .CCC) and sound formats (MIDI, .WAV, and .VOC). The Windows environment also helps to bolster the program's ease of use by making all the necessary tools readily available as icons (in a toolbox along the left side of the screen) or as menu selections.

Where *Madison Ave.* adopts a slide show approach, *Curtain Call* resembles a simplified video production unit. Although *Curtain Call* lacks the sophisticated time line metaphor (and the subsequent production quality) of a product such as MacroMind's *Action!*, it does provide effective and accessible control over your presentations. The program's graphic representation of a script greatly decreases the time that is needed to build and enhance a presentation.

A *Curtain Call* presentation includes elements referred to as "events." Events include the background screen, a graphic clip, a sound or voice file, a music file, and a control mechanism. In order to create a script, you place each event along a series of frames. Events that are placed in the same frame will appear together during the presentation. You control the progression of an entire frame by instructing a screen element to respond as a timer, as a keystroke or mouse click, or to wait on another event, such as a voice file or sound effect.

SLIDES FROM SCRATCH

Curtain Call has an especially strong selection of design tools and a comprehensive paint toolbox, which allows you to create entire images from scratch. (Clip art, charts, and graphs from other programs can also be imported.) You can create background screens using any of 236 colors and shades on both palettized or nonpalettized VGA displays. With a nonpalettized display, Windows will use dithering in order to create the range of colors. Experienced paint-program users will orient themselves quickly. Novice users can bring themselves up to speed quickly by following the well-written tutorial.

Curtain Call **displays a script editor where you synchronzie graphics, sound effects, music, and transitions to create a slide show. As a Windows-based program, it lets you import a wide variety of files from other graphics programs.**

Although it does not have a charting or graph-making facility of its own, *Curtain Call*'s abundance of design features make it a solid complement to any business graphics shelf. When it is used with a Windows spreadsheet program, *Curtain Call*'s strong capabilities for creating titles can enhance any presentation. In fact, the company bills the package as a "presentation titling" package. You can create dazzling titles using any font that your Windows environment supports, including Windows bitmapped fonts, or fonts from *Adobe Type Manager*, *Facelift*, and *Morefonts*.

Unlike *Action!*, *Curtain Call* has no facility for exporting presentations to videotape. This is an unfortunate and curious omission, as Zuma Group claims video production houses among its target audience. And with no runtime version available, you must take your hardware with you when you deliver your presentation or install a copy of *Curtain Call* on the system you use to deliver the presentation.

If you take the latter route, you'll need two copies of the software and must make sure that the system configuration on the PC you use to create the presentation matches the configuration of the PC you use to deliver the presentation. If you run into problems, Zuma Group can provide technical assistance. It's not toll-free, and the company suggests calling between 1 and 4 P.M., which is a pretty narrow window for users who may be on deadline. If you choose to deliver your presentation in a more traditional manner, you can print frames for use with overheads.

You can create impressive title slides in *Curtain Call* by applying special effects such as glows and strobes to type. It also has a well-stocked Paint Box for freehand drawing. Here, a sound file is added to a frame.

With these restrictions, it's worth considering what advantages a program like *Curtain Call* can bring to your business presentations. While neither *Madison Ave.* nor *Curtain Call* offers animation, user interactivity, or the free-form branching capabilities of full-fledged multimedia presentation packages, both *Curtain Call* and *Madison Ave.* are easy alternatives to traditional video production and answer a need for many companies looking to contain costs and training time. ■

List Price: *Madison Ave.*, Version 1.0, $169.95. **Requires:** 640K RAM, 3MB hard disk space, VGA or better monitor, DOS 3.1 or later. For sound effects, music, and voice, additional requirements include a sound card (Ad Lib or Ad Lib Gold, ATI Stereo F/X, Sound Blaster, Sound Blaster Pro, Thunder Board); external speakers or headphones; and a microphone. Eclipse Technologies, 1221 West Campbell Rd., #125, Richardson, TX 75080; 800-456-6434, 214-238-9944.

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List Price: *Curtain Call*, Version 1.0, $199.95. **Requires:** 386SX-based PC or better, 2MB RAM, 5MB hard disk space, 16-color VGA or 256-color SVGA monitor, Windows 3.0 or better. For sound effects, music, and voice, additional requirements include a sound card (several are supported), external speakers or headphones, and a microphone. Zuma Group, 6733 North Black Canyon, Phoenix, AZ 85015; 602-246-4238.

CIRCLE 423 ON READER SERVICE CARD

WinJet/800

CONTINUED FROM PAGE 37

all. The package includes 50 Type 1 fonts—imitations of the standard PostScript 35 plus 15 display faces—and you can add any other PostScript font.

If WinJet's PostScript isn't fast enough for you, you can use its GDI (Graphic Device Interface) mode instead. This mode doesn't waste time translating Windows graphics calls into PostScript commands and can print at breathtaking speed, although you don't regain control of the keyboard as quickly as in PostScript mode. The WinJet prints in GDI mode only at 300 dpi, while the WinPrinter/800 model also has a 400-dpi GDI mode.

The advantages of WinJet's PostScript mode, beyond increased resolution, are that it has a print manager that lets you modify the print queue, it lets you print files from disk, and it can generate thumbnail images of multipage files. You can also print alternate pages or pages arranged for folding into booklet form.

WinJet's speed depends on the speed and efficiency of your CPU. On a 33-MHz 486 machine, it needed 2 minutes 40 seconds to print a Ventura PostScript file at 800 dpi; the same file needed 6 minutes 45 seconds with a LaserJet III and an HP PostScript cartridge at the much less processor-demanding resolution of 300 dpi. A *WordPerfect* text file using downloaded fonts took 32 seconds in 800-dpi PostScript mode and only 22 seconds in the WinJet's 300-dpi GDI mode. But at 300 dpi, the file needed 44 seconds with *ATM* and a LaserJet III and 1 minute 24 seconds with a LaserJet III and PostScript cartridge.

A WinPrinter/800 attached to a 25-MHz Compaq Deskpro 386e in PC Labs produced lesser performance. The 400-dpi GDI mode was about as fast as the 300-dpi LaserJet, but 800-dpi PostScript was typically half as fast.

Fast, advanced computers may present installation problems. The WinPrinter/800 loaded effortlessly on PC Labs' 25-MHz Compaq, but when we installed the WinJet on a 486-based EISA machine, we had to change a jumper to remove an IRQ conflict with the hard disk controller. Then Windows locked up when loading the WinJet software, apparently because of a conflict with *Super PC-Kwik* running under *QEMM-386* 6.02.

Once you get the software running, the package offers the best printing you can get on a desktop. You don't need the WinPrinter—it's about as cheap to buy a WinJet and a LaserJet III. But if you've got the hardware, you won't find more flexible, economical, elegant Windows printing than that from the WinJet/800. ■

The sample on the left was printed at 300 dpi with *ATM* and the LaserJet III, with Resolution Enhancement Technology turned on. The notably smoother sample on the right was printed at 800 dpi with the WinJet/800. The smaller type is 10 point.

List Price: WinJet/800, $995; WinPrinter/800, $2,195.
Requires: 8MB RAM, one 16-bit slot (AT-bus or MCA), Microsoft Windows 3.0, 8MB Windows swap file. WinJet/800 requires LaserJet II, IID, III, or IIID. LaserMaster Corp., 6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-365-4646, 612-944-9330.

CIRCLE 424 ON READER SERVICE CARD

Personal Access

CONTINUED FROM PAGE 37

driven and consists of over 200 command and functions statements that control message handling, properties, navigation, visual and sound effects, menus, and other user-interaction tools. Most scripts are automatically created when the cards are designed; a built-in editor is included for more advanced customizing and programming of PPL scripts. PPL also provides support for dynamic data exchange (DDE) with other Windows applications.

Personal Access is a front end for the *PLUS* system that extends its capabilities to accessing data from external databases. The version we looked at includes support for *dBASE*-type .DBF files, Novell's *Btrieve*, and the Microsoft/Sybase *SQL Server*. Support for *Oracle* and *Paradox* databases is due to be included by early March 1992.

Database files can be accessed alone or joined with others to create complex lookups and interrelationships. *Personal Access* doesn't limit you to working with only one type of database file at a time. If a common field exists, multifile stacks can access data from different database formats at the same time. Additional PPL commands are also added by *Personal Access* to support accessing external databases.

When first started, *Personal Access* displays the default "home" stack on the desktop, which lets you organize other stacks in various folders (represented by folder icons) and it includes a row of buttons to provide fast access to the various stacks, features, and modules.

Personal Access cards can be designed to show only one record at a time or to display multiple records in a table. When a link exists between two or more databases, the card stack can display the child records, related to the parent record that is visible on the first card, on subsequent cards in the stack.

Designing database card stacks is very easy using the point-and-shoot toolkits. In addition to the *PLUS* toolkit, *Personal Access* provides an on-screen navigation menu that lets you move quickly from card to card or back to the home stack, and a Quick Tools toolbox that accesses the basic tools for creating cards.

Personal Access comes with external utilities that assist in database management and can be run either directly from Windows or from within the *Personal Access* environment. The Table Maintenance program lets you create and change database files, and Joiner lets links between different database tables be created and saved for later use. Index Finder manages *dBASE*-type indexes, creating the associations needed for *Personal Access* to use them when accessing .DBF files.

The final piece of the *Personal Access* system is the *PLUS* Reports module. This is a WYSIWYG report designer that lets you create custom row-and-column or free-form reports and mail-merge letters and forms from data contained in *PLUS* stacks.

All these features and functionality have a downside. The minimum recommended system needed to use *Personal Access* is a 386 machine with 4MB RAM and a VGA monitor; installing the full application takes up a little over 5MB of hard disk space. These recommendations should be viewed as a bare minimum, though; the Windows hourglass was our constant companion when running *Personal Access* on a 20-MHz 386 test system with 8MB RAM.

Users looking for an easy way to access existing databases through the Windows environment will find *Personal Access* a good way to do so. The *PLUS* system is also available separately for those who want to work only with hypermedia and have no need to access external databases. ■

List Price: *Personal Access* with *PLUS*, Version 2.5, $695. *PLUS* 2.5 alone, $495.
Requires: 80386-based PC or better, 4MB RAM, DOS 3.1 or later, Microsoft Windows 3.0. Spinnaker Software Corp., 201 Broadway, Cambridge, MA 02139; 617-494-1200.

CIRCLE 425 ON READER SERVICE CARD

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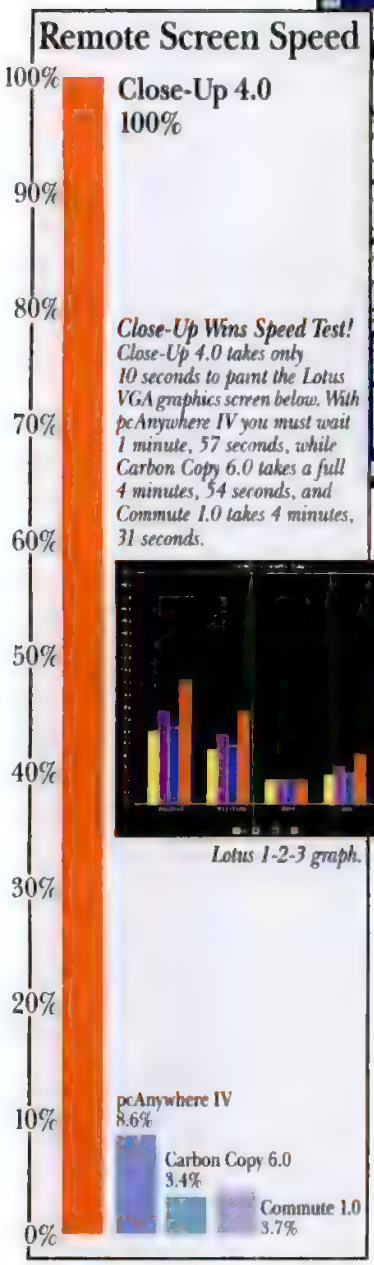
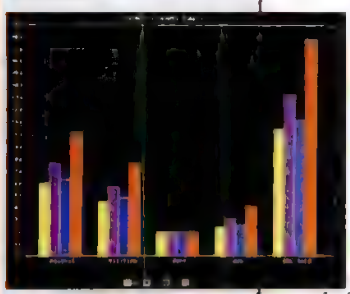
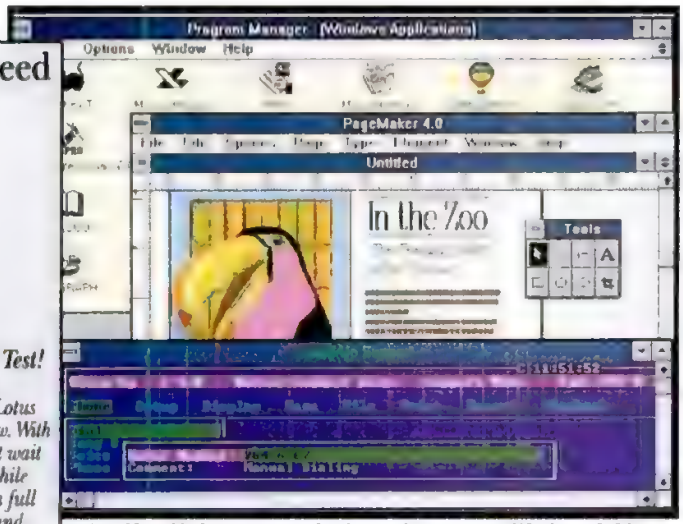


Close-Up Wins Speed Test! *Close-Up 4.0 takes only 10 seconds to paint the Lotus VGA graphics screen below. With pcAnywhere IV you must wait 1 minute, 57 seconds, while Carbon Copy 6.0 takes a full 4 minutes, 54 seconds, and Commute 1.0 takes 4 minutes, 31 seconds.*



Lotus 1-2-3 graph.

In the time it takes Close-Up to paint 100% of the above Lotus VGA graph, pcAnywhere IV has painted just 8.6%, Carbon Copy 6.0 has painted just 3.4% and Commute 1.0 has painted just 3.7% of the graph.



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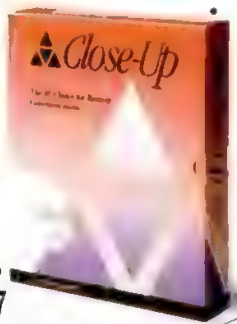

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[†]We invite you to reproduce our Remote Screen test. The graph used was a color VGA graph found in Lotus 1-2-3 Release 2.2, on the "Sample Files Disk." The file is TUTOR9X.WK1. The PCs were Everex 16 MHz 386/SXs and the modems Hayes 2400 baud Smartmodems. The baud rate was 2400.

[‡]Only Close-Up passes the Windows test. 1. Total remote keyboard and mouse support in all Windows modes: 386 Enhanced, Standard and Real. 2. Remotely run multiple Windows applications and multiple (full screen or windowed) DOS applications simultaneously. 3. Use a mouse to remotely cut & paste between windowed DOS applications and Windows applications.

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CIRCLE 028 ON READER SERVICE CARD

VGAStereo F/X Board: ATI Adds Decent Sound to Great Video in a One-Slot Solution

HANDS ON

With its $449 VGAStereo F/X, ATI Technologies Inc. has squeezed one feature onto its multimedia audio board that its competition lacks: a fast, capable Super VGA controller. This multimedia offering and its audio-only sister product, the $199 Stereo F/X, fail to offer some audio features that hi-fi buffs and sophisticated users will demand, but they may provide just the right mix for those interested in tapping the sound capabilities of existing entertainment and education applications.

While ATI's Stereo F/X includes Voyetra Technologies' audio drivers and utilities for DOS and Windows 3.0, the VGAStereo FX, the package *PC Magazine* received for evaluation, includes everything that you will need to coax better sound out of your PC. The VGAStereo F/X packages consist of a set of inexpensive speakers, a MIDI connector box—which furnishes the only speaker-out and line-in jacks—and Voyetra Technologies' 64-track sequencer, Sequencer Plus Junior.

The VGAStereo F/X also includes a mouse port and a 400-dpi, three-button Microsoft-compatible mouse. (ATI's Stereo F/X features speaker-out and line-in jacks and a 15-pin joystick/MIDI port, which can also be used to attach the optional MIDI connection hardware.)

Both offerings lack a CD-ROM drive, a SCSI interface to connect it, and Microsoft Windows 3.0 with Multimedia Extensions. As a result, ATI does not possess MPC compatibility, but its boards offer both AdLib and Sound Blaster support. In other words, you should have no problem running most applications featuring sound.

As a video controller, the VGAStereo F/X employs essentially the same ATI controller that drives the ATI VGAWonder XL—a *PC Magazine* Editors' Choice ("Super VGA Boards: Fast Enough for Windows, Cheap Enough for You," September 24, 1991)—and offers the same switchless installation and excellent performance. The $449 version has 512K DRAM and supports 256 simultaneous colors at resolutions of 640 by 480 and 800 by 600, along with a 16-color mode at 1,024-by-768 resolution.

An additional $50, which brings the list price to $499, buys you a full megabyte of RAM and 1,024-by-768 resolution with 256 colors. You also get the 32,000 simultaneous colors of the Sierra Hi-Color RAMDAC chip at 640-by-480 and 800-by-600 resolutions. The VGAStereo F/X supports the 72-Hz VESA refresh rate as well, though you'll need the full 1MB to reach 72 Hz in Super VGA modes.

SOME OBVIOUS AUDIO OMISSIONS

As audio boards, the two ATI offerings comprise a rather odd mixture of thoughtful engineering and obvious omissions. On the upside, you get the same 11-voice FM synthesizer employed by just about every other audio board currently available, the Yamaha YM3812, and a few capabilities not so widespread: an on-board 8-watt power amp stage that allows direct connection to inexpensive speakers, various levels of hardware compression, and automatic level control, which ATI claims will boost the 48 decibel dynamic range of the board to an effective range of 100dB. ATI stresses that the board's filtering capabilities and other enhancements produce the best sound possible given the hardware environment.

Unfortunately, the boards' drawbacks and omissions will outweigh its advantages for many buyers. ATI has provided no sound jack for acceptance of CD-audio signals inside the machine. If you want to route audio signals from a CD-ROM drive to the ATI board, you'll have to run a cable from the drive's headphone jack to the line-in jack of the Stereo F/X or the MIDI box of the VGAStereo F/X.

That ATI has built in only one input jack and no multichannel mixing capabilities constitutes an even more serious drawback. You can buy a connector at any Radio Shack that will let you connect a microphone, CD player, and tape drive to the single input, for example, but you'll suffer the limitation of being able to record from only one device at a time.

Unlike Media Vision's Pro-Audio Spectrum and Creative Labs' Sound Blaster, which provide two YM3812 synthesizers for 22-voice stereo synthesis, the ATI boards provide only one Yamaha chip. ATI has compensated for this somewhat by adding channel separation capability, which simulates stereo sound from mono signals, giving you improved sound on games and other software that support the de facto AdLib standard.

A final notable drawback concerns the quality of audio available through the single audio output jack. ATI's 8-watt power amp will do a fine job with inexpensive speakers, but those who want to connect the board to a stereo amplifier or receiver for optimal sound will be disappointed: The signal will be tarnished by amplification.

The Voyetra software included with the VGAStereo F/X is becoming a familiar multimedia bundle, and for good reason. It provides drivers and utilities that let you record, edit, and play sound files from within DOS and Windows 3.0, even without the Multimedia Extensions. It also includes a selection of 25 MIDI song files to add to your multimedia presentations.

The ATI VGAStereo F/X may prove a tempting offer for those who want to upgrade both their PC video and audio capabilities and use only one slot in the process. Unfortunately, the audio capabilities make more sense for those who want good sound from game packages and who have relatively straightforward recording needs than for buyers looking toward a futuristic world of multimedia. Those who want to add a CD-ROM drive, hook their sound board to an external amplifier, or record simultaneously from a number of line inputs should look elsewhere. ■

The $449 VGAStereo F/X includes two small speakers to play your audio files.

FACT FILE

ATI VGAStereo F/X
ATI Technologies Inc., 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2; 416-756-0718.
List Price: With 512K RAM, $449; with 1MB RAM, $499; Stereo F/X, $199; MIDI connector box and Sequencer Plus Junior, $79.
Requires: DOS 3.0 or later.
In Short: This multimedia board combines MIDI and synthesizer capability with a full-featured SVGA controller and has everything you need, including speakers, to get better sound out of your PC. Formidable limitations make it suitable primarily for use with existing entertainment and educational software.

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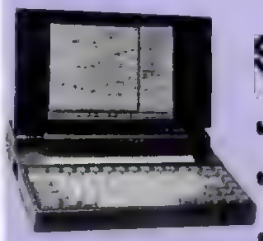

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IBM's LAN Utilities Solve Problems Remotely

HANDS ON
by M. [illegible]

As the role of LAN administrator becomes increasingly complex, the need for tools that can quickly serve up system-wide information becomes more critical. IBM's *LAN Management Utilities/2* (*LMU/2*), designed to work on IBM's *LAN Server* or Microsoft's *LAN Manager* running IBM's OS/2 1.3 Extended Edition, makes networks more manageable by giving you the resources to solve problems at the client, LAN, and enterprise systems levels.

The utilities in *LMU/2* ($480) include a command transport system, management applications, and a central repository for data collection. User-written applications can supplement those supplied with the package. *LMU/2* collects valuable information about all of the nodes on the network—DOS version, display type, installed memory, I/O ports, free disk space, and types of disk drives—and presents its findings in a simple text-based format.

It also allows designated LAN servers to manage other stations on the LAN. The managing system requires IBM's OS/2 1.3 Extended Edition, which includes a complete SQL database called the Database Manager. You can use this tool to sort the information gathered by *LMU/2*.

Additionally, *LMU/2* tracks the contents of the CONFIG.SYS and AUTOEXEC.BAT files, which proves especially useful in help-desk scenarios by allowing LAN managers to run programs and execute commands on remote OS/2 computers.

For example, if a user named Bob is having trouble running *Lotus 1-2-3/G*, you issue the command "LMUCMD BOB_PC TYPE CONFIG.SYS" to check his LIBPATH and PATH environment variables. If the directory "C:\OS2APPS\123G" is not included, *LMU/2* lets you add it remotely.

Or, if a user cannot connect to the accounting server, you can run the NET USE command on the user's computer to see its list of available resources. You can also reboot a client PC.

LMU/2 operates strictly with OS/2 REXX files, an OS/2 batch language that provides more commands for writing bulletproof programs than its DOS counterpart. Each *LMU/2* program executes on the node attached to the network. It includes interfaces for both C and SQL programming languages.

For example, company rules may prohibit users from tampering with their systems' hardware and software. If a client PC changes an AUTOEXEC.BAT file, *LMU/2* can generate an alert and a REXX program can notify the department manager of the event.

With the included data conversion program, you can send the collected information in DB2 format to an MVS host (an IBM mini- or mainframe) for analysis against other corporate data. Optionally, *LMU/2* commands can be issued from an MVS host.

In conjunction with IBM's $245 *System Performance Monitor/2*, *LMU/2* can also gather performance information, send alerts, and trigger REXX programs. In its own right, *LMU/2* provides excellent data-gathering features that yield valuable information for network managers and LAN support technicians. ■

List Price: *LAN Management Utilities/2*, first server, $480; additional server licenses, $449. **Requires:** Managing System OS/2 1.3 Extended Edition, IBM's *LAN Server* 1.3; DOS client requires DOS 3.3 or later and a *LAN Manager* Requester; OS/2 client requires OS/2 1.3 or later and a *LAN Manager* Requester. IBM Corp., P.O. Box 12195, Dept. B55, Research Triangle Park, NC 27709; 800-426-2468.

CIRCLE 427 ON READER SERVICE CARD

VisiNet Keeps LAN Control Close to Home

HANDS ON
by Steve [illegible]

Monitoring a large wide-area network (WAN) can entail lots of travel and phone calls, particularly if the network stretches nationwide. The ability to manage networked devices such as UNIX systems, wiring centers, routers, and bridges from a single PC can be a real time-saver.

Managers of such networks who like to have complete control of their far-flung networks from the comfort of the home office know of VisiSoft's $1,995 *VisiNet*, Version 2.0, available in four configurations for Novell's *NetWare*, IBM's *LAN Server*, Microsoft's *LAN Manager*, or any NetBIOS-compliant LAN.

But even more interesting is *VisiNet for SNMP* ($2,495), the fifth and newest *VisiNet* flavor. It has the same graphical interface and menus found throughout the *VisiNet* family of products, but unlike the others, it uses the Simple Network Management Protocol running over the Transmission Control Protocol/Internet Protocol (TCP/IP) to manage important devices on your LAN or WAN.

VisiNet for SNMP includes real-time monitoring of your network and an unlimited number of views of your LAN. You can use background maps of the world, countries, or states to illustrate the location and design of your network, or you can focus the view on offices or floors—whatever map best defines your LAN or WAN.

The program runs under Windows, and dynamic data exchange (DDE) and object linking and embedding (OLE) make it possible for you to send LAN monitoring reports to other Windows apps (such as *Excel*) for real-time reporting and charting updates.

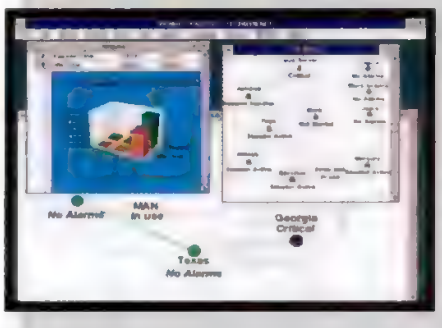
The program includes a moderately complex proprietary object-oriented scripting language to create alarms for network devices. For example, you can instruct *VisiNet* to send you an alarm (by LAN e-mail or by audio beep) when a server has gone down or is transmitting an unusually large amount of packets.

A History Activity Log is maintained to remind you of past problems, and the included Discover utility lets you search for any device on the network. The Inventory Control Module gives you up to 135 user-definable fields on hardware and software.

VisiNet for SNMP includes a TCP/IP kernel from NetManage Inc. TCP/IP allows LAN stations to communicate with other platforms as long as the other platform is running TCP/IP. In the near future, NetManage plans to ship a new version of its TCP/IP kernel that will contain an SNMP agent allowing the network manager to gather and control even more information from network devices. ■

List Price: *VisiNet for SNMP*, Version 2.0, $2,495. **Requires:** 4MB RAM, 5MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0. VisiSoft, 430 10th St. N.W., #S008, Atlanta, GA 30318; 800-847-4638, 404-874-0428.

CIRCLE 428 ON READER SERVICE CARD



Using *VisiNet*'s background maps, you can create graphical representations of your network. Another feature allows you to import network information into an *Excel* spreadsheet or chart.

We apologize.

What we really meant was:
QEMM-386 makes the most of every last 'K'—automatically. It finds more RAM between 640K and 1 megabyte than DOS 5 or any other memory manager. Lots more.

We under-sold Optimize.
Optimize does everything we said it does, but it manages your memory much more smoothly and quickly than you'd guess from this ad. It checks out virtually every possible combination of memory mapping—automatically.

We under-stated high memory gain.
QEMM-386 finds even more memory than we said—211K additional high memory in most cases. (We wanted to be conservative, but on most PCs, we got over 200K more room for TSRs and drivers between 640K and one megabyte.)

Oops!
When we said that all other memory managers require you to manually re-allocate memory between expanded and extended types, we should have said most memory managers require manual re-allocation, and none find more useable high memory.

We left out Squeeze.
Some TSRs require a lot more memory to start than they do to run. Squeeze increases available memory to accommodate their memory demand, then cuts it back to just what's necessary. The result? You can get more TSRs and utilities out of the way, and eliminate wasted memory.

Then there's VidRAM.
QEMM-386 can use memory set aside for graphics when you only need text. That's up to an additional 96K without rebooting!

Manifest is included, free.
Award-winning Quarterdeck Manifest is included with both QEMM-386 and QEMM 50/60. It's a $60 value that provides information you simply can't get any other way. And it makes memory simple to understand.

Save time; gain performance.
QEMM lets you use the TSRs you want and still leaves lots of room for network drivers, utilities and memory-hungry programs. You'll get fewer "out of memory" messages and get more work done smoothly and quickly.

Apparently this ad was misleading.

Trying not to over-promise, we were too cautious with our claims.

The truth is, QEMM-386 v.6 is better than we made it sound.

Not only does it typically find a lot more memory than we claimed, it also does its memory management job more quickly, smoothly and unobtrusively than we lead you to believe.

Results of running QEMM-386 v.6 with Stealth*

	DOS 3.3		DOS 4.0		DOS 5.0	
Model	DOS Program Size	Avail High Mem	DOS Program Size	Avail High Mem	DOS Program Size	Avail High Mem
IBM PS/2 80	581K	211K	572K	211K	620K	211K
Compaq 20e	581K	211K	572K	211K	620K	211K
ALR VEISA	582K	211K	573K	211K	620K	211K

This chart shows how big a DOS program can be and how much high memory is made available when you use our new QEMM-386. Sorry it isn't more colorful.

#1
QEMM is the #1 selling utility according to PC Magazine.

Stealth, our new RAM-gain feature, 'maps' ROM into other areas of memory—to provide you with the maximum available RAM between 640K and 1 megabyte. That's space QEMM then uses to load memory-hogging TSRs and drivers (like network software) out of the memory areas your big programs need.

How it works is not as important as the end result—more useable high memory—as much as 211K!

Our Optimize feature works better, too. From its new interface to the way it works with Stealth to calculate memory usage better, for maximum memory gain.

QEMM has won more recognition than all other memory managers combined.

QEMM-386 helps your programs run faster by giving them more memory. And it works great with any DOS from 3.3 to 5. And Windows, too. It's an essential tool for anyone who wants to get the most productivity out of the hardware and software they're using today.

Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802

* Here we are, being cautious again: Because Stealth alters the memory mapping of your PC, how much high memory you'll gain depends on the 'BIOS' in your computer. We've tested Stealth on a wide range of PCs, from Compaqs to PS/2s; ALRs, Toshibas and many others. Typically, an additional 211K becomes available between 640K and 1 megabyte. Depending on your PC, your memory gain may vary.

CIRCLE 338 ON READER SERVICE CARD

Weitek for Windows: Affordable And Quick Windows Acceleration

People who work extensively with Windows spreadsheet packages like *Microsoft Excel* and *Lotus 1-2-3 for Windows* or with graphical word processors such as *Microsoft Word for Windows* and *Ami Pro* don't need a lot of color to get the job done. And often their work is hampered by the sluggish scrolling provided by a standard VGA graphics card under Windows.

With a list price of $299, the Weitek Power for Windows is a budget-priced solution for faster video performance. Aimed at Windows' users who spend most of their time in word processors, spreadsheets and other less variegated Windows apps, Weitek Power hits the mark with responsive bit block transfers (Bitblts), line drawing, and scrolling—the meat-and-potatoes graphic calls for text-intensive Windows apps.

At the heart of the Weitek Power for Windows card is Weitek's W5086 graphics chip, which supports 16 colors only. The board is clearly intended for heavy text work under Windows, but its lack of 256 color support makes unsuitable for serious graphics work. This limitation also leaves it below the Multimedia PC specification. The accompanying disk has 16-color Windows drivers at 640-by-480, 800-by-600, and 1,024-by-768 resolutions; these install easily with Weitek's setup program. Weitek also includes drivers for popular DOS software including *AutoCad, WordPerfect, Lotus 1-2-3,* and *Ventura Publisher*.

If you're used to 256 colors under Windows, Weitek Power will seem a bit drab. If you are currently running VGA, its images will seem comparable to what you currently have.

Setting up Weitek Power is easy, aided by a clear and complete explanation in the 58-page user's guide. Like many graphics cards nowadays, it has jumper switches to configure its ROM and RAM to work without conflicting with other add-in cards, although the default factory jumper settings are likely to work smoothly in most PCs.

The graphics accelerator built into the W5086 is comparable to (but simpler than) a Weitek math coprocessor chip in its interaction with a PC. The graphics chip and its host PC share a small part of the main PC memory. The PC sets up a graphics operation in shared memory and then triggers the graphics accelerator to go do it while the PC is off doing something else.

Benchmark results measured on our testbed 25-MHz Compaq Deskpro 386 put the Weitek Power for Windows card in a favorable light compared with the ATI VGA Wonder XL Plus (see chart), an updated version of the Editors' Choice from *PC Magazine's* last Super VGA roundup ("Super VGA Boards: Fast Enough for Windows, Cheap Enough for You," September 24, 1991). And the Weitek card is likely to have even greater impact in a slower PC, since VGA and Super VGA Windows drivers are incredibly CPU intensive and benefit from PCs with more processing power.

Compared against a Windows accelerator, the S3-based Orchid Fahrenheit 128°, the Weitek Power for Windows card yields throughput from one-third to two-thirds of the Orchid card (First Looks, November 26, 1991), which now carries a retail price of $399. ATI's board is currently available for about $200.

Weitek Power offers improved Windows performance over Super VGA, but constant price reductions leave this board being squeezed at both ends. If you can afford to spend the additional $100 or require more than 16 colors under Windows, look elsewhere. But if 16 colors are all you need and your current VGA graphics performance leaves you waiting and waiting, the Weitek Power for Windows card deserves consideration, especially if you're on a tight budget. ■

FACT FILE

Weitek Power for Windows
Weitek Corp. 1060 E. Arques Ave., Sunnyvale, CA 94086; 800-845-0150, 408-738-8400.
List Price: $299.
Requires: 286-based PC or better, 640K RAM, DOS 3.1 or later, Windows 3.0 or later.
In Short: Weitek sacrifices color for speed under Windows. Optimized for text-based Windows apps like spreadsheets and word processors, it is a fast, low-cost alternative, but you may find better bargains out there.

CIRCLE 435 ON READER SERVICE CARD

WEITEK POWER FOR WINDOWS

We compared the Weitek Power for Windows graphics card with representative Super VGA (ATI Technologies' VGA Wonder XL Plus) and Windows accelerator cards (Orchid's Fahrenheit 1280°) to show relative performance. The Weitek card is optimized to provide fast bit block transfers (BitBlt) and line drawing, the staple diet of many text-oriented Windows applications. Its Windows drivers are also finely tuned to scroll quickly through text, a real time-saver for users of Windows-based spreadsheets and word processors. The fast scrolling is not readily apparent, however, since the VGA Wonder XL Plus is also highly adept at performing text scrolls.

The **Aligned** and **Nonaligned BitBlt** tests draw a 256- by 256-pixel square and use the Microsoft Windows 3.0 function BitBlt (bit block transfer) to move it from one screen location to another—which is similar to moving a cursor, icon, or window across the screen. Nonaligned BitBlts require more CPU overhead because it is necessary to compute the screen-memory offset position.

The **Draw Horizontal** and **Draw Vertical Lines** tests use the Windows 3.0 LineTo function to draw lines on-screen. For noncoprocessed boards, diagonal line draws are far more CPU-intensive, since both *x* and *y* coordinates are incremented.

The **Random Rectangles** test measures the time it takes the graphics adapter and driver to draw a series of random rectangles, which is a common Windows operation used in drawing title bars and menus.

The **Font Scrolling** tests fill an entire window with a particular display font, then scroll through it, horizontally or vertically. The score given is the average of five tests: the **Scroll System Font, Scroll TmsRmn 21-Point Font, Scroll TmsRmn 27-Point Font, Scroll Helvetica 20-Point Font,** and **Scroll Helvetica 24-Point Font** tests.

We performed all tests using Windows 3.0 in 386 Enhanced mode on a Compaq Deskpro 386/25e with 8MB RAM, running at 800-by-600 pixel 16-color resolution, with a screen refresh rate of 72 Hz.

GRAPHICS PERFORMANCE TESTS FOR WINDOWS 3.0

Higher scores represent better performance.

	Throughput (thousands of pixels per second)					Throughput (characters per second)
	Aligned BitBlt	Nonaligned BitBlt	Draw Horizontal Lines	Draw Vertical Lines	Random Rectangles	Font Scrolling
Orchid Fahrenheit 1280°	21,113.7	20,007.8	4,103.2	4,072.4	9,599.3	49,710.0
Weitek Power for Windows	13,075.8	12,379.0	3,013.3	1,928.9	7,253.3	21,185.0
ATI VGA Wonder XL Plus	6,058.7	931.6	2,032.6	844.6	5,761.7	18,775.0

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CIRCLE 313 ON READER SERVICE CARD

WinTools Transforms Windows with Clever Desk and Tool Metaphors

HANDS ON
by Barry Simon

If you like the drag-and-drop environment of Microsoft Windows and *Norton Desktop for Windows*, chances are you'll love Tool Technology Publishing's $149 *WinTools*. This replacement for Windows' Program, File, and Task Managers is a revolutionary revamping of the way Windows works and looks. Many Windows users, especially new ones, will find it very attractive.

The fundamental object in *WinTools* is the icon-based Tool. A set of 12 basic tools, including Desk, Options, Tree, Dynamic Data Exchange (DDE), Keystroke, Trash, Directory, and Note, comes with the program. User tools are created from your applications and files. When you install *WinTools*, it creates a Desk for each one of your Windows' Program Groups and turns all of your applications into tools. You can add icon images from the program's large image library, create new tools, and rearrange the content of your Desks in any fashion that suits your needs as you work with the program.

It's not so much the elimination of most menus but their replacement with a new metaphor that makes *WinTools* revolutionary. *WinTools* goes beyond the use of icons as representations of applications and allows tools to act upon other tools. For example, if you want to change a tool's font, you drag it to an Option tool that pops up a dialog box.

Throughout the program, you will find lots of other ways that tools can interact. There's one tool that resizes other tools, a tool that attaches notes, and another tool that makes a copy of a tool. Keystroke and DDE tools enable you to launch an application and directly send it the appropriate keystrokes or DDE commands.

DRAG-AND-DROP FILE MANAGEMENT

WinTool's Tree tool handles file management. If you have multiple drives, you can use the Copy and Option tools to set up trees for each drive and use the Open Tree tool to display a tree and directory in side-by-side windows. Then simply click and drag to rearrange directories and files. So that you may quickly access the files, applications, or directories you use most frequently, you can turn them into standalone tools simply by dragging them to the desktop.

Norton Desktop can turn a program or file into an icon and let you print a file by dragging it to a print icon, but *WinTools* takes this ability a critical step further by letting you drag a file to a Program tool that will launch the program automatically, along with the selected file.

This may seem like a relatively new way of working on the PC, but Pubtech's *File Organizer* has had this ability for several years. And it's no coincidence that this modus operandi is similar to that of a shareware program called *Aporia* from NewTools. Its principal programmers are also behind *WinTools*.

Rather than spilling all its tools onto the desktop as *Aporia* does, *WinTools* organizes tools into Desks and gives you the ability to reorganize them. You can even configure a Desk to display icons without titles or spaces so that the window looks like a toolbar. The program ships with sample toolbars for several applications, including *Microsoft Word for Windows, Ami Pro, Microsoft Excel*, and *WordPerfect for Windows*. These toolbars, however, don't compare to the visual elegance and ease of use offered by the Power Toolbar in *Power Launcher*.

UP TO 16 VIRTUAL SCREENS

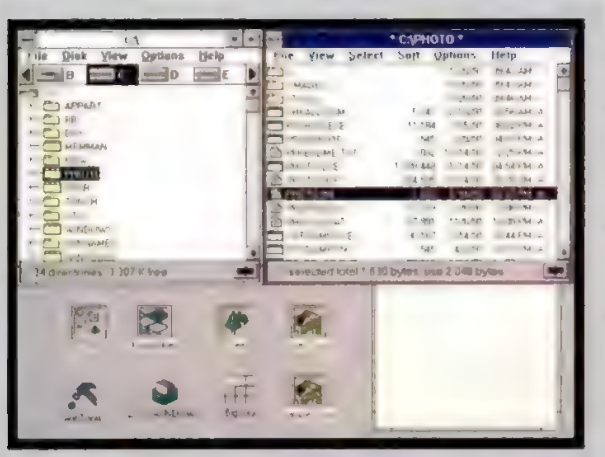
WinTool's multiple virtual screen feature, Big Sky, exceeds the desktop management ability of Windows' Task Manager. Like Attitash Software's *WideAngle*, Abacist Software's *HotWin*, and hDC's *Power Launcher*, *WinTools* gives you a virtual desktop that's bigger than a single screen. Big Sky displays nine virtual screens by default, arranged in an array that's three screens long by three screens wide. It can display up to 16 virtual screens.

Big Sky is like a grand task-switcher that provides nine full and separate screens. Now imagine popping up a wide-angle view that shows all nine screens and their windows. You can drag representations of the windows from screen to screen, but can work on them only when you return to Big Sky's full-screen view.

For applications that are able to open multiple files at once, you can select several files and drag them all to the application's tool for launching. You can also configure any program to launch at a prespecified time. And with *WinTools*' network security features, you can restrict the rights of users to reconfigure their setups and to view directories and drives.

WinTools meets a high standard of functionality and ease of use, but it also exhibits some glaring deficiencies and a few inconsistencies. It won't let you record sequences of keystrokes or even single keystroke commands. Instead, you must fill in a Keystroke Input text box with appropriate codes or function keys. In addition, the file manager is missing a viewer, even for text files. And you would expect that by dragging the Desk tool to the Option tool you could align the tools inside a Desk. In this case, however, you have to call up a Desk window's system menu or double-right-click inside the appropriate window.

Like *Aporia*, *WinTools* is a program that you'll either love or hate. New Windows users are likely to take to it like a duck to water, but more experienced users may find the new way of working disconcerting. *WinTools* is an ambitious attempt to change the Windows metaphor, and in many ways, it succeeds. ■

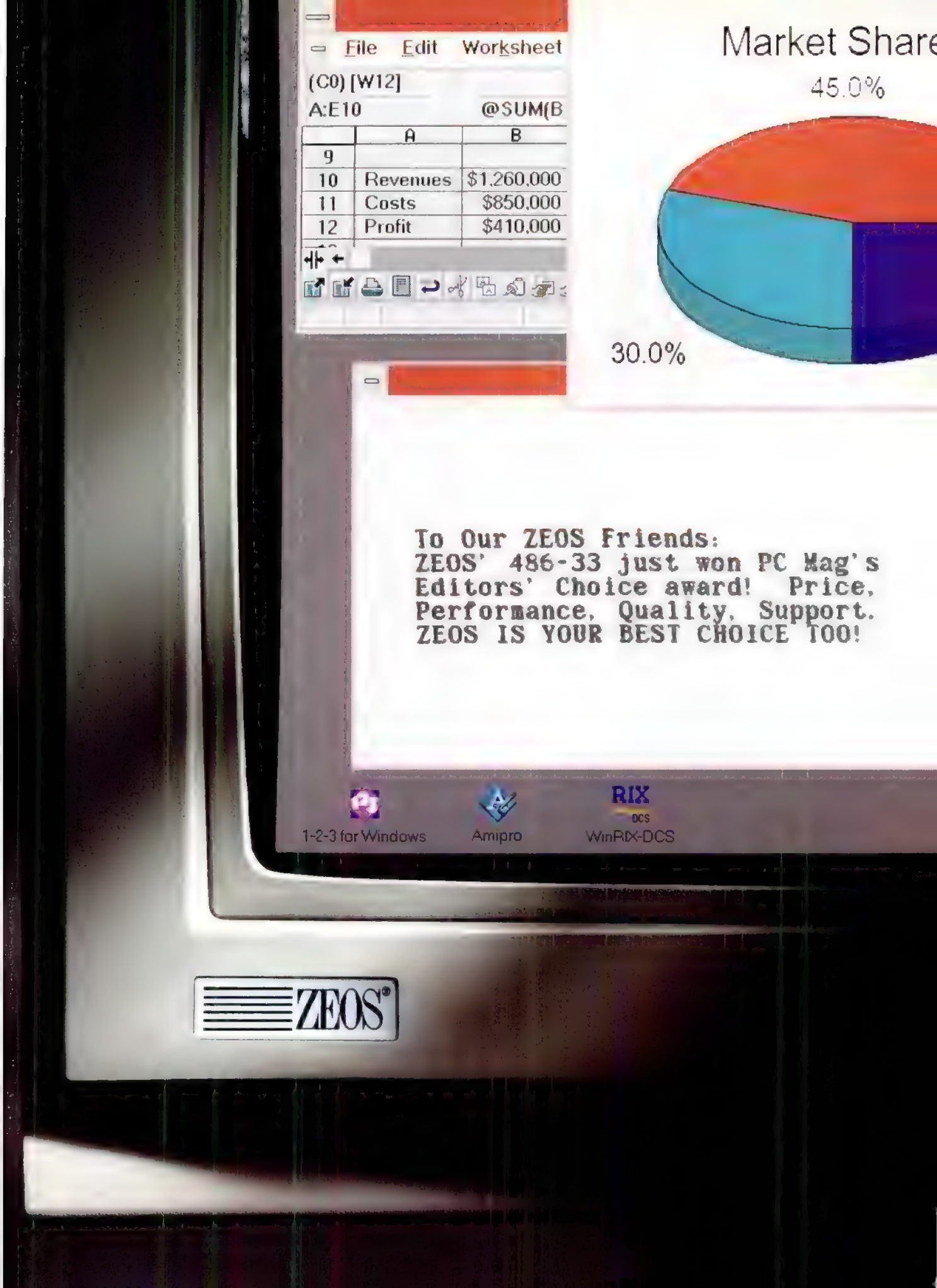


***WinTools* displays a side-by-side file tree and directory listing and supplies tools for sending DDE commands and keystrokes to applications.**

FACT FILE

***WinTools*, Version 1.0**
Tool Technology Publishing, 1125 A St., #107, San Rafael, CA 94901; 415-459-3700.
List Price: $149.
Requires: 640K RAM, 1.2MB hard disk space, Microsoft Windows 3.0, DOS 3.1 or later.
In Short: *WinTools* replaces Windows' Program Manager, File Manager, and Task Manager and carries the visual object-oriented metaphor to new levels.

CIRCLE 419 ON READER SERVICE CARD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9
10 Revenues $1,260,000
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12 Profit $410,000
Market Share
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These are not some scaled down versions or trial disks either. They are the *complete* and *fully documented* editions of Lotus *1-2-3 for Windows* and Lotus *Ami Pro 2.0* for *Windows* provided to you by special arrangement between ZEOS and Lotus. This is one incredible value that no one else can offer. You're going to love it, too.

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ZEOS-486-33

PC MAGAZINE EDITOR'S CHOICE 2-11-92

Upgradable. High Performance. Low Cost. And every ZEOS Windows system comes with Lotus *1-2-3 for Windows* and *Ami Pro 2.0* at no additional charge. Absolutely incredible!

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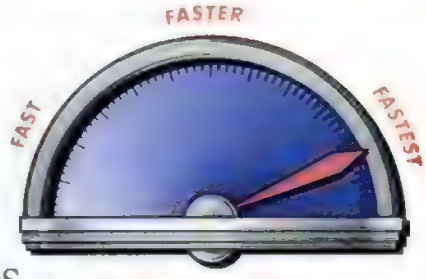

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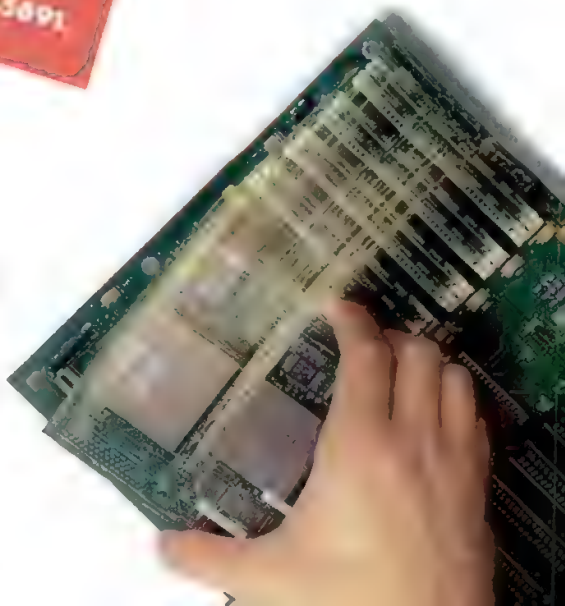

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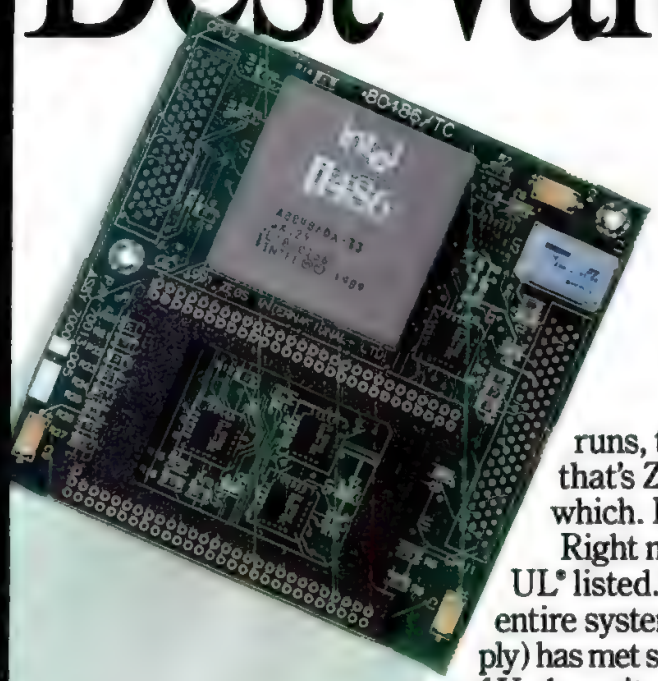

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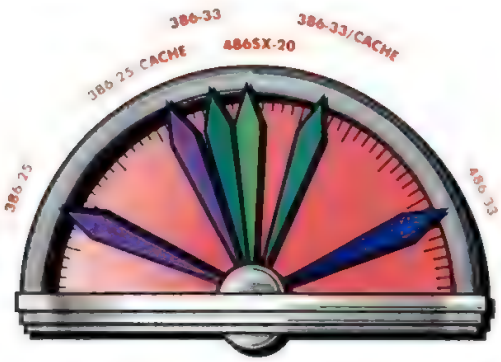

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Atlas MapMaker Brings High-End Mapping Tools to Windows

HANDS ON
By Rock Miller

If you regularly produce data maps for your presentations and publications, you'll want to take a good look at *Atlas MapMaker for Windows* from Strategic Mapping Inc. This thematic mapping package (which lists for $395) is similar in purpose to Software Publishing Corp.'s *Harvard Geographics*, but it's much more sophisticated in its geographic and mapping capabilities.

MapMaker's big plus is its well-designed multiple-document interface, which incorporates a *Microsoft Excel*–like data worksheet, a paperlike drawing screen, and an easy-to-use map gallery. The program does a great job of producing shaded thematic maps and calculating ranges based on equal intervals or equal numbers of cases, and it supports a full range of colors, patterns, and legend options. It also supports more unusual types of data maps: dot-density maps (useful in population studies), pie maps (in which a pie chart is shown over each region), and symbol maps (in which each region has a symbol that varies in size with the data value). There's even a so-called "prism map", a 3-D plot in which the apparent height of the region varies with the data value. (For maps of any complexity, however, the results tend to be rather confusing.) In all cases, you can easily specify variables and other settings through well-designed dialog boxes.

Though it's relatively simple to use, the program is remarkably sophisticated in its capabilities. For instance, it supports multiple layers, which makes it possible to create multivariate maps by overlaying one over another, and you can selectively hide or overlay geographical elements (for instance, highways or plant sites). The program also comes with a good range of symbols and drawing functions, making it an excellent tool for creating freehand maps.

MapMaker's boundary files (containing geographic features) are separate from its data files. Since the program understands latitude and longitude coordinates, you can merge separate boundary files in their proper scales and relationships to one another. You can copy or move elements from layer to layer, and though the program does not do geocoding, you can create facsimiles of pin maps using the symbol map function (the symbols are placed at the centroids of the regions) by overlaying boundary files of points onto your base maps, or by placing point symbols (which are customizable) manually. A wide range of maps comes free with registration, and many others are available at extra cost. You can also import maps in .DXF format.

Data handling is likewise good. You can import data in comma- or space-delimited ASCII form (*MapMaker*'s native format), or in *Lotus 1-2-3*, SYLK, .WK1, or *Excel* 2.1 formats (there's no support for *Excel* 3.0 worksheets). There's a good range of cut-and-paste tools, and there are even functions for mathematical transformations and basic statistics. Importing a boundary file places the unique IDs of its geographic features right into the worksheet, ready for data entry, and you can merge multiple data files within a single worksheet.

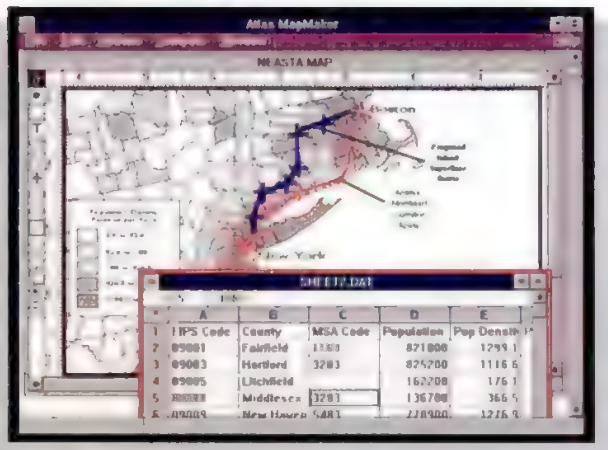
MapMaker's advanced geographic capabilities will probably interest few users but are noteworthy nevertheless. Its ability to convert boundary files among Albers, Mercator, and Miller projection systems lets you select the right projection for your task. If you need latitude and longitude lines on your map, the program can calculate and apply them. And if you need to reshape or simplify existing map regions and draw your own, the program's tools are sufficient (pressing the Ctrl key while drawing automatically snaps to the closest borders and vertices of existing map regions).

In spite of these advantages, some important imperfections limit *MapMaker*'s usefulness. Though the program's drawing and annotation tools are, by and large, excellent, the menus are not "sticky," so repetitive actions frequently require you to make repetitive selections. There's no way to drill down to select underlying objects except by pushing the top object to the bottom, which may well obscure it. Line widths are infinitely variable, but you have no control over line-end styles. And you can group and ungroup only map regions, not text or annotation elements.

Though *MapMaker* benefits from Windows' color and font support, problems exist in these areas as well. Though you can mix your own colors, you cannot create and save palette files, a major inconvenience when you're trying to create subtly shaded thematic maps. And text handling is merely adequate (it supports multiline text and basic justification, but no word wrapping). Worst of all, when using *Adobe Type Manager*, fonts and letters both on-screen and in printed output can be noticeably distorted.

MapMaker's printing functions are well thought out. You can print a window view as well as the entire map page; various options let you center the map on the page, split the map across multiple pages, or scale the map—either to fit the page or to a given percentage of its size (this last feature is a godsend if you're short on printer memory). However, the only way to export completed maps is through the Windows Clipboard—a crippling limitation, particularly when you're working with large, complex maps.

MapMaker is a worthwhile purchase if you can live with its imperfections. It's a good design with much potential, but Strategic Mapping needs to make some important improvements in its next version. ■



***Atlas MapMaker* has an overlay function and tools for drawing freehand maps. This freehand map of railway routes is overlaid on a thematic map using population density as a variable.**

FACT FILE

***Atlas MapMaker for Windows*, Version 1.01**
Strategic Mapping Inc., 4030 Moorpark Ave., #250, San Jose, CA 95117; 408-985-7400.
List Price: $395
Requires: 286-based PC or better, 1MB RAM (2MB recommended), 5MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0, mouse
In Short: A Windows-based way to get data maps without dealing with a full-fledged geographic information system, *MapMaker for Windows* is well designed and very usable, but it lacks some key capabilities in file exporting and text handling.

CIRCLE 416 ON READER SERVICE CARD

Three Low-Cost Windows PIMs Make Sense of Your Schedule and To-Do List

HANDS ON
By Jonathan Matzkin

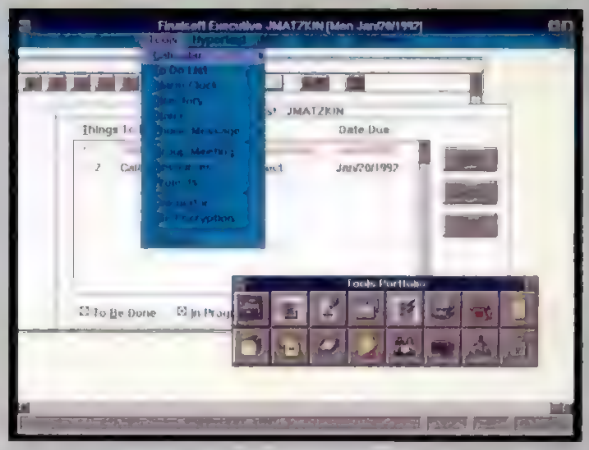
Windows 3.0 provides a hospitable environment for personal information management. Since Polaris Software pioneered the Windows PIM category with *PackRat*, several other vendors have introduced products that aim to organize your life as you shuffle from pane to pane.

Finalsoft Executive, from Finalsoft Corp., offers powerful groupware functionality—including e-mail and group scheduling—but its rich PIM features make it worth consideration for use as an individual productivity tool. Its reasonable single-user price ($99) adds considerably to *Executive's* appeal. *Active Life*, from ISoft Corp., is a more modest program that emphasizes scheduling and notetaking as a means to organizing your personal information. Since it's a shareware app, you pay the registration fee of $149 only if *Active Life* meets with your approval.

Organize!, another shareware product, is more of a free-form notetaker than a full-fledged PIM. But for users with modest info management needs, it could well be more than equal to the job. And at $35, it doesn't have to become one of your central applications in order to earn its keep. Both of these shareware products are available in CompuServe's Advanced Windows forum (enter "GO WINADV" at any ! prompt), and a working demo of *Executive* can be downloaded from the same forum.

All of *Executive*'s main features can be accessed either from the program's main menu bar or from its toolbar, which can be positioned on-screen. A highly capable text editor displays text attributes on-screen and supports easily created hypertext links to text or graphics files. The personal calendar tracks appointments for individual users and allows for considerable flexibility in data entry; the group scheduler analyzes the commitments of individual attendees, reports conflicts, and suggests a best fit time slot for the meeting.

There is also an extremely flexible to-do list generator that makes excellent use of colors, icons, and symbols. A detail window for each task displays additional information, including free-form note text.



All of *Finalsoft Executive*'s main components are available from the main menu bar as well as from a toolbar that can be repositioned on-screen. The multiuser version can spot group scheduling conflicts.

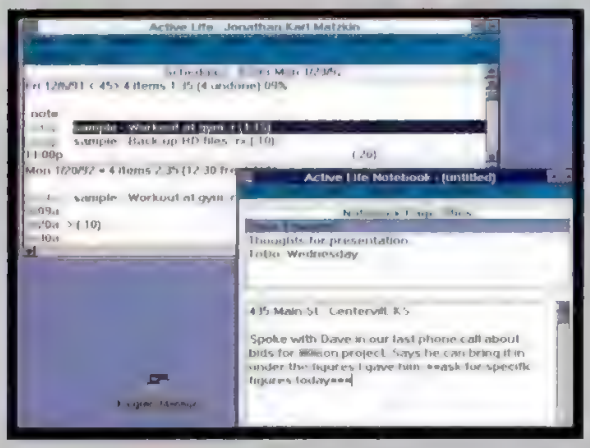
Executive's alarm module beeps when you ask it to, but it goes far beyond merely imitating your clock radio. You can specify a text string to be displayed when the alarm goes off or instruct the alarm to load and run any program of your choice. Alarms can be scheduled to repeat at daily, weekly, or monthly intervals.

While not as elegant or comprehensive as General Information's *Hotline*, *Finalsoft Executive* does effectively keep track of your struggles with the telephone. There are separate personal and group phone-number databases and an ingenious "while you were out" note generator that is best exploited in network environments.

Many of *Executive*'s tools are simply customized front ends for a *dBASE III Plus*-compatible database. You can generate your own simple database templates for organizing information that doesn't fit neatly into the preconfigured components.

The database isn't particularly well-suited to handling free-form information, though, and that's *Executive*'s primary weakness as a PIM. Since you can't search globally for a string or search for a text string within a memo field, you have to exercise some discipline in entering your data. The ability to retrieve hastily entered bits of information, as you can with Chronologic's *Instant Recall* and Micrologic's *Info Select*, would be a welcome addition to *Executive*.

For the purposes of this review, we focused on *Executive*'s PIM capabilities and did not test its groupware functions. Most of the multiuser capabilities, however, are quite viable on a standalone PC when running a multiuser version of *Executive*. Our evaluation copy supported up to six users, all of whom can be assigned passwords, e-mail mailboxes, and hierarchical access privileges. This presents intriguing possibilities for offices where multiple users share a single workstation. Users can grant fellow users access to their own databases, phone lists, and schedules, and the group scheduling module can spot conflicts as long as each individual keeps his or her schedule current.



***Active Life*'s two main components are a very flexible scheduler and a notetaking module that stores both text and graphics material. The auto-dialer can find and dial phone numbers located in a note.**

ACTIVE LIFE FOR WINDOWS

Active Life for Windows is a PIM for those who want a variety of different views of their schedule. The program has two basic components: a scheduler and a notetaker, which can be invoked from within the scheduler or run separately from its own Program Manager icon.

For its user interface, the *Active Life* scheduler adopts a souped-up version of the traditional

CONTINUES ON PAGE 52

Borland ranked best
Quattro Pro beats Lotus 1-2-3

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Number of ...	Quattro Pro 3.0[1]	Lotus 1-2-3 v. 2.3[2]	Lotus 1-2-3 v. 3.1[3]
"Excellent"	7	2	3
"Very Good"	8	4	5
"Good"	0	5	4
"Satisfactory"	2	5	3
"Poor"	0	1	1
Overall score	**8.4**	**6.3**	**6.5**

[1] Source: *InfoWorld*, April 29, 1991 [2] Source: *InfoWorld*, June 10, 1991
[3] Source: *InfoWorld*, January 28, 1991

REPORT CARD — INFO WORLD

SPREADSHEET SOFTWARE
Quattro Pro
VERSION 3.0

Criterion	(Weighting)	Score
Performance		
Formulas/analysis	(100)	Very Good
Compatibility	(50)	Very Good
Speed	(75)	Very Good
Database	(75)	Excellent
Graphics	(75)	Excellent
Output	(50)	Excellent
Macros	(50)	Very Good
Consolidation/linking	(50)	Excellent
Capacity	(50)	Very Good
Network	(50)	Satisfactory
Documentation	(50)	Excellent
Ease of learning	(50)	Excellent
Ease of use	(75)	Very Good
Error handling	(50)	Very Good
Support		
Support policies	(25)	Very Good
Technical support	(25)	Satisfactory
Value	(100)	Excellent
Final score		**8.4**

We don't blame Lotus for trying to underplay ratings such as these, but clearly Quattro Pro is more powerful. It has better graphics, better capacity, better macros, better consolidation and linking, and much more!

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INFOWORLD PRODUCT OF THE YEAR 1990

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B O R L A N D

Software Craftsmanship

CODE: MJ67

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CIRCLE 285 ON READER SERVICE CARD

Windows PIMs

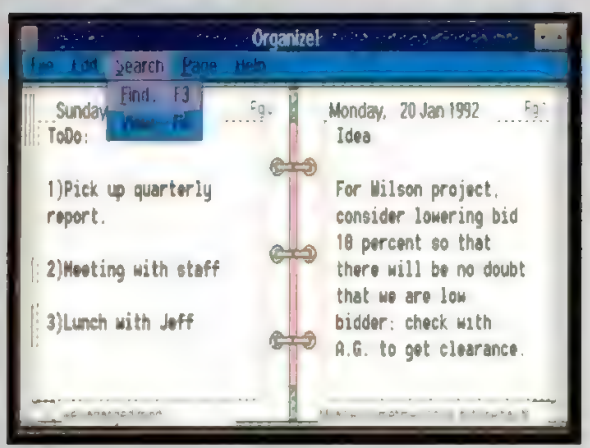
CONTINUED FROM PAGE 50

paperbound "at-a-glance" calendar. *Active Life*'s View menu lets you display as many as seven schedule windows—each containing a single day's agenda.

Entering an appointment is a simple process, accomplished through *Active Life*'s Edit menu, which offers numerous options for entering repetitive appointments and for tracking tasks. Scheduled items need not be associated with start or end times, but can function as notes or comments in your schedule. The Juggle menu provides easy repositioning of schedule items, and the Select menu and pop-up calendar allow you to navigate in time.

Active Life's "notebook" is divided into two windows. The top window contains a scrollable list of titles, each one of which corresponds to a note that is displayed in the lower window. The notebook's search function allows you to search for a string in the titles or in the main body text of the notes.

The notebook's auto-dialer can search for and dial any recognizable phone number within a note. The dialer makes the notebook quite useful for keeping phone lists and other simple database-oriented files. You can import Windows Cardfile, unformatted text, and ASCII database files into notebook files. It also has simple graphics import capabilities.



***Organize!* is a simple notetaker with PIM capabilities. It uses a diary metaphor as its user interface and is able to search for user-specified word strings. To open a fresh page, you click on the corner of a page.**

ORGANIZE!

The simplest of the three programs evaluated here is *Organize!*, a notetaker in the tradition of *Tornado Notes*. The interface is a graphic representation of a small, open book. You enter text as if writing in a diary, and click on the corner of a page to turn to a fresh page. Actually, the small size of the book makes it seem more like a Post-It pad than a full-sized notebook, but the book metaphor is charmingly rendered and easily learned.

Once you enter text, you can search for it by entering any string in *Organize!*'s search menu. The on-line user's manual gives some excellent suggestions for using this simple tool to organize a variety of information. However, it lacks an auto-dialer and many other PIM components; *Organize!* is more like a cleverly designed desk accessory than a full-fledged PIM. ■

List Price: *Finalsoft Executive*, Version 1.2, single-user version, $99; six-user version, $445; 10-user version, $695. **Requires:** 1MB RAM, 6MB hard disk space, Microsoft Windows 3.0, Novell's *NetWare* 2.10 or later or equivalent NetBIOS network supported by Windows 3.0 (for multiuser use). Finalsoft Corp., 3900 NW 79th Ave., #215, Miami, FL 33166; 800-232-8228, 305-477-2703.

CIRCLE 431 ON READER SERVICE CARD

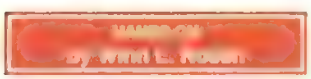
List Price: *Active Life for Windows*, $149. **Requires:** Microsoft Windows 3.0. 1Soft Corp., P.O. Box 1320, Middletown, CA 95461; 800-326-4391, 707-987-0256.

CIRCLE 432 ON READER SERVICE CARD

List Price: *Organize!*, $35. **Requires:** Microsoft Windows 3.0. Mr. Kewk Sing Cher, Software Park, Ghim Moh Estate, P.O. Box 1004, Singapore (9127), Republic of Singapore.

CIRCLE 433 ON READER SERVICE CARD

IDE-to-Micro Channel Host Adapter Smooths A Difficult Connection



Installing an IDE hard disk in a PS/2 is a painful experience, and today's only balm is the AC-1070 IDE/Micro Channel adapter from Arco Electronics. This clever but expensive adapter ($195 retail, $160 to $175 on the street) bridges the differences between the two standards and delivers excellent performance.

Because the most common form of IDE—the AT Attachment interface—is based on the AT expansion bus, it is not directly compatible with Micro Channel architecture. Slide the stubby, 7-inch-long AC-1070 into any Micro Channel expansion slot, however, and you can plug one or two IDE drives into your PS/2. You will get full bootability and arbitration abilities (but not bus mastering). The AC-1070 adapter will work along with or in lieu of an IBM hard disk controller.

The AC-1070's secret is its on-board BIOS, which replaces some of the host computer's firmware to provide a consistent disk interface (through hardware interrupt 14) that's compatible with DOS, OS/2, and *NetWare* (the latter through drivers supplied with the board).

The standard Micro Channel Programmable Option Select procedure handles setup—just run the setup program on your Reference Diskette. The AC-1070 even adjusts itself and your system to the capacity of your hard disk.

The AC-1070's performance is a delight. In testing with a Seagate ST157A hard disk (essentially an ST-506 drive adapted to an IDE interface), we found 50 percent higher throughput than with the standard IBM PS/2 Model 60 drive, a 40MB hard disk that uses the ST-506 interface. For example, using DOS function calls, the AC-1070 adapter wrote to the test drive at a rate of 245K per second, compared to 160K per second for the standard IBM controller/drive combination.

The only software-related problem: a conflict with *Super PC-Kwik*. Caching the drive connected to the AC-1070 slowed its response from milliseconds to full seconds.

ANSI (the American National Standards Institute) is working to develop a Micro Channel version of IDE. If experience is any guide, however, such a standard won't eliminate the need for adapters like the AC-1070. Micro Channel–interfaced IDE drives will be more expensive and rarer than their AT-bus equivalents.

Although the AC-1070 is expensive compared to AT-bus IDE adapters, making it an unlikely match for cheap IDE disk drives, it's a good complement to large, fast hard disks. This adapter will give your PS/2 what it needs to take advantage of the industry's most popular hard disk interface. ■

List Price: AC-1070 IDE-to-Micro Channel Host Adapter, $195. **Requires:** Micro Channel computer; DOS 3.3 or later. Arco Electronics Inc., 5830 Sheridan St., Hollywood, FL 33021; 305-961-1666.

CIRCLE 430 ON READER SERVICE CARD

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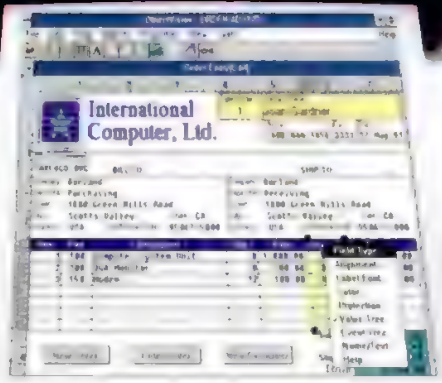

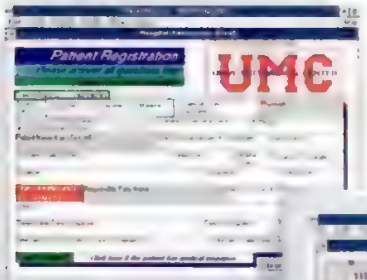

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CIRCLE 287 ON READER SERVICE CARD

Improved Foto Touch Stitches Logitech Hand Scans Together

One of the limitations of hand scanners is that their typical 4-inch widths are too narrow to scan full pages. Logitech has gone a long way towards solving this problem with Version 2.0 of *Foto Touch Image Editing Software*, the software which comes with its $449 ScanMan 256 hand scanner.

Foto Touch includes an intelligent auto-stitch module that uses pattern recognition to piece together successively scanned strips. From the Windows-based image editor, you invoke the scanner module and choose single or multiple-strip scanning in up/down, left/right, or right/left orientation. If you pick multiple passes, you just have to be careful to overlap scanning strips by a half-inch to an inch and a half. The scanner module then pieces the strips together and places a single picture into *Foto Touch*.

The scanning module works well at the recommended 100 dots-per-inch as long as you're careful about the overlap restriction. This module is separate from the *Foto Touch* program and is written to the new TWAIN specification for hand scanner access. Other programs written to access TWAIN modules can also run the ScanMan 256. *Foto Touch* is one of the first TWAIN-aware applications on the market, but several vendors, including Aldus and Zsoft, are working on adding TWAIN links to some of their programs (see the Trends section in this issue).

Foto Touch is an upgrade to the software that shipped with the original ScanMan 256 and keeps all the former versions' capabilities. To basic gray-scale pixel editing, it adds brightness and contrast controls, smoothing and sharpening filters, and cut-and-paste features.

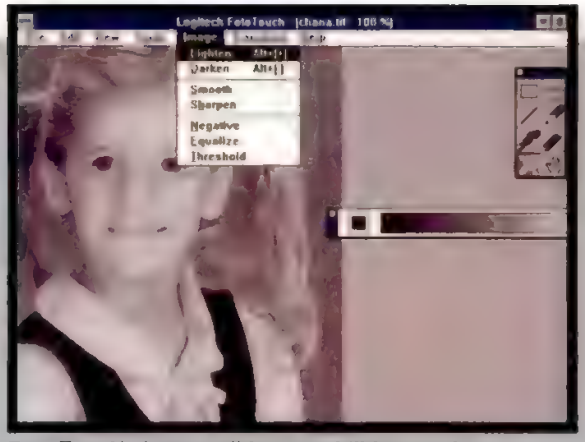


***Foto Touch*'s image-editing capabilities aren't as extensive as those of full-featured image editors, but its auto-stitch feature works well.**

To test *Foto Touch*'s features, we scanned in a photo of a young girl with a scrape on her face. By magnifying the image and using copy and paste, we copied skin from her chin and pasted it over the scrape. Then we selected the rough area and used the smoothing filter to touch it up.

While *Foto Touch* is great for a program that comes bundled free with hardware, it isn't nearly as powerful as Zsoft's new *PhotoFinish* (see First Looks, February 11, 1992). With *PhotoFinish*, we could have used more sophisticated blending tools to touch up the girl's chin further.

The new *Foto Touch* is a great supplement to the ScanMan 256, already the standard in 256 gray-scale hand scanners with its 400-dpi true 256 gray-scale capabilities. With auto-stitch smarts like *Foto Touch* has, hand scanners have overcome one of their big limitations. ■

List Price: ScanMan Model 256, $449. **Requires:** 1MB RAM, 2MB hard disk space, one half slot, Microsoft Windows 3.0. Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717; 510-795-8500.

CIRCLE 420 ON READER SERVICE CARD

Accessories Rest Your Wrists and Protect Your Notebook

With more and more discussion about PC-related hand and wrist injuries in the news, accessories designed to minimize such risks are proliferating. PC Compatibles has introduced a family of products that are designed to protect you from injuries and your PCs from damage.

PC Compatible's line of ergonomic devices include (clockwise from top left) the Foot Turtle, Notebook combo, and the Lap Cat.

The products are all made out of lightweight, medical-grade foam. First there's the Lap Cat ($39.95), a keyboard rest that sits in your lap. With a keyboard tucked into it, the Lap Cat provides wrist support, helping you to keep your wrists at an angle that is less likely to cause strain or a repetitive strain injury like Carpal Tunnel Syndrome (see "Does Your PC—or How You Use It—Cause Health Problems?" in Lab Notes, *PC Magazine*, Nov 26, 1991).

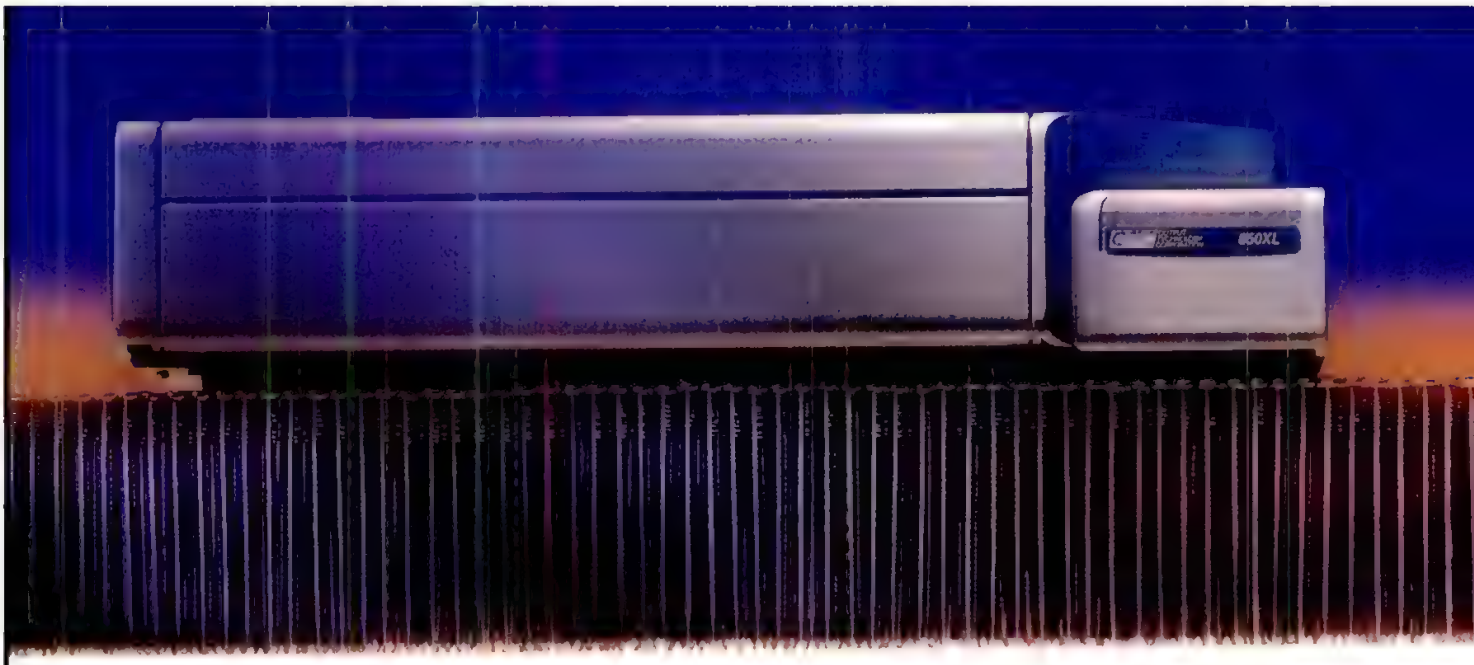
The $19.95 Wrist Perch is designed for a desk surface that has no built-in keyboard support or wrist protection. You place it under your keyboard and it provides the same wrist support as the Lap Cat but without the soft foam cushion underneath. Its non-skid surface also helps keep your keyboard from wandering. A foot rest, called the Foot Turtle ($29.95), lets you keep your legs and feet at a comfortable angle to the floor.

The most recent addition to the PC Compatibles line is the Notebook Wrist Perch/Lap Cat combination ($27.96). This notebook protector provides the same general features as its desktop siblings while solving a couple of problems specific to notebook computers. For one, the non-skid surface keeps your notebook from slipping and becoming damaged. The 8.5- by 11-inch design also fits nicely into a briefcase, providing an extra cushion to protect your notebook against a jarring blow.

And for notebooks that tend to warm up with extended use, the product puts a layer of heat-resistant foam between you and your laptop. ■

List Price: Lap Cat, $39.95; Wrist Perch, $19.95; Foot Turtle, $29.95; Notebook Wrist Perch/Lap Cat combo, $27.96. PC Compatibles Inc. PO Box 46 Chappaqua, NY 10514; 800-487-0781; 914-238-7818.

CIRCLE 421 ON READER SERVICE CARD



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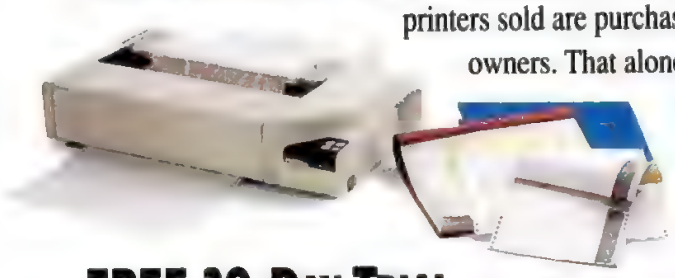

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CIRCLE 245 ON READER SERVICE CARD

More Windows: More Screen Real Estate For Fewer Dollars

HANDS ON
by Richard Hale Shaw

If your Windows desktop looks as jammed as a Manhattan street corner, you might acquire a bigger monitor. Or you might consider Aristosoft's *More Windows* 3.0, a $99 package that extends the Windows desktop beyond the edge of your EGA or VGA monitor.

Up to 1,024 pixels wide on either axis, *More Windows* creates the illusion that your monitor is a viewport onto a larger, virtual desktop. To move the viewport, you sweep the mouse pointer to the edge of the screen. *More Windows* will slide the display using the video hardware's panning abilities.

More Windows offers five different modes for virtualizing the desktop display. Portrait color mode extends the screen vertically with a 640-by-800 display. It's best suited for working with a word processor, since you can extend a document window to the full height of the virtual display and then use *More Windows* to pan the screen swiftly. It's far faster than relying on a word processor's pokey scrollbars and screen repaints.

Landscape color mode's 1,024-by-511 display extends the screen vertically as well, but this mode is best for spreadsheets (which usually have more columns than rows) or for tiling two full-size applications side by side.

More impressive are the two full-page modes. Both extend the virtual desktop to 1,024 pixels on each axis, and both have benefits and limitations.

Full-page mono mode emulates a paper-white display. In addition to the normal view, it features two other views. Compressed view displays the entire virtual desktop on one screen, and offers a Bird's-Eye option that magnifies the area under and around the mouse pointer in a window on the right side of the display. Mag view magnifies the entire desktop: Everything is much bigger, but a much smaller portion of it is displayed at a time. You use the right mouse button to switch between views.

Unfortunately, this mode is not without a few bugs: In both Compressed and Mag view, the mouse pointer drew black blurs as it moved and eventually turned my screen (run by a Video-7 adapter) into a black smudge.

The full-page color mode is not as versatile: It's a 1,024-by-1,024 virtual desktop without the frills of paper-white mode. You can only use full-color mode in Windows' Standard and 386 Enhanced modes, and it requires 300K of extended memory. If you need to use Real mode or don't have the memory, use square color mode, an 800-by-600 version of full-page color mode.

While *More Windows* doesn't force you to switch between different segments of the virtual desktop like Attitash Software's *Wide Angle* does, it doesn't extend your screen real estate nearly as much. And if you can stand the eyestrain, some video display vendors offer drivers that can compress a color display to fit 1,024 by 1,024 pixels on a single screen.

Nevertheless, *More Windows* remains an inexpensive way to increase your screen real estate, and you'll enjoy its effortless, instantaneous panning around the extended screen. ■

List Price: *More Windows*, Version 3.0, $99. **Requires:** 300K RAM, DOS 3.1 or later, Microsoft Windows 3.0.
Aristosoft Inc., 6920 Koll Center Pkwy., #209, Pleasanton, CA 94566; 800-338-2629, 510-426-5355.

CIRCLE 418 ON READER SERVICE CARD

Crystal Ball Gives Excel Modeling a Boost

HANDS ON
by Craig Stinson

Decisioneering's *Crystal Ball* 2.0 ($195) is a new Windows version of a "Monte Carlo analysis" add-in for the Macintosh version of *Excel*. Like Palisade Corp.'s *@Risk* (also recently ported to *Excel*, from *Lotus 1-2-3*, Release 2.*x*), the program is designed to make *Excel* a sharper tool for analyzing risk and evaluating decision alternatives.

Most spreadsheet software does an inadequate job of modeling situations that involve multiple unknown values. Monte Carlo add-ins help by letting you specify the range and distribution parameters for each of your models' unknowns. The programs run iterative simulations, generating a specified number of random values for each input. The outcomes are tabulated, charted, and analyzed with descriptive statistics, allowing you to analyze risks and probabilities and make informed decisions.

Crystal Ball is a particularly versatile and easy-to-use example of the genre that exploits the graphical user interface to superb effect. The program uses an add-in macro to attach itself to the main *Excel* menu bar. When running a simulation, however, it operates as a separate Windows application, communicating with *Excel* via dynamic data exchange (DDE). Thus, you can run simulations in the background while you continue working in *Excel* or in another Windows application. Simulations can also be interrupted and resumed at will.

To define a simulation, you select an input cell and choose from a gallery-style menu of 11 standard distribution types: normal, triangular, poisson, binomial, lognormal, uniform, exponential, geometric, weibull, beta, and hypergeometric. (You can also define your own "custom" distribution, if none of these meets your needs.) A separate graphical dialog box for each distribution type lets you set parameters by directly manipulating a probability curve.

Crystal Ball 2.0 generates histograms showing the probability distribution for each forecast cell in your model.

You can specify as many input cells as you like, test their impact on any several cells at once, and run the simulation for any number of iterations—all up to limits imposed by system memory. For each output cell, the program creates a histogram of the resulting values.

By default, the histogram displays 100 percent of the possible outcomes, but you can manipulate endpoints on the chart to get the program's probability estimate for any given range.

Simulation parameters are automatically saved with worksheet data for easy reuse. Result charts, plus a large assortment of descriptive statistical information, can be written into a separate *Excel* worksheet as an attractively formatted report.

Crystal Ball won't take the risk out of making decisions, but it can give you a better night's sleep. ■

List Price: *Crystal Ball*, Version 2.0, $195. **Requires:** 512K RAM, Microsoft Windows 3.0 or later, DOS 3.1 or later, *Microsoft Excel* 3.0.
Decisioneering Inc., 1727 Conestoga St., Boulder, CO 80301; 800-289-2550, 303-447-6464.

CIRCLE 417 ON READER SERVICE CARD

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CIRCLE 053 ON READER SERVICE CARD

by Emerson Andrew Torgan

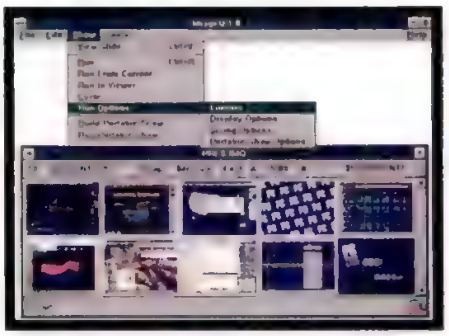
New & Improved

News of Announced Products and Upgrades

ImageQ Takes the Slides Out of Your Presentation

NEW **Image North Technologies** is shipping its true-color image presentation package for Windows. *ImageQ*, Version 1.0, is designed to replace 35-mm. slide presentations by loading 8-, 16-, or 24-bit color graphics image files such as .BMP, .GIF, .PCX, Targa, and TIFF for display under Windows. Slide sorting is offered by filename or through thumbnail-view image display. *ImageQ* also creates standalone portable slide presentations; one file contains the entire presentation.

When used with an 8-bit color card, *ImageQ* automatically enables a proprietary algorithm to perform real-time color reduction and selection of the optimal 256 color palette for the most effective presentation. The package's scripting language lets the user set or alter the flow of the presentation, delete and create files, and launch external applications. Also, various transition effects such as wipes and tiling can be used in a presentation.



***ImageQ*'s slide strip window functions like a light table, allowing users to view and arrange image files.**

List Price: *ImageQ*, Version 1.0, $349. **Requires:** 386-based PC or better, 2MB RAM, 8-, 16-, or 24-bit Windows-compatible graphics card, Windows 3.0. Image North Technologies, 180 King Street South, #360, Waterloo, Ontario, Canada N2J1P8; 800-363-3400, 519-570-9111.

CIRCLE 402 ON READER SERVICE CARD

VP-Expert Lets Users Add Graphics to Expert Systems

IMPROVED **WordTech Systems** has added .PCX file support, new string-handling functions, and enhanced graphic tracing and animation facilities to its rule-based expert system development tool. According to WordTech, *VP-Expert*, Version 3.0, is an artificial intelligence model that approximates human reasoning in the development of analytical applications. With its .PCX file support, *VP-Expert* users can now add graphics images to illustrate their expert applications.

Developers define the rules based on an expert's knowledge and judgment or let the program's induction table create a system based on examples entered with comparison and logical operators. The application can be further refined with information from spreadsheets, database programs, and end-user responses to a series of on-screen questions.

List Price: *VP-Expert*, Version 3.0, $349. **Requires:** 512K RAM, two floppy disk drives, DOS 2.*x* or later. WordTech Systems Inc., 21 Altarinda Rd., Orinda, CA 94563; 510-254-0900.

CIRCLE 403 ON READER SERVICE CARD

HOT PROSPECT

WINJET 800 UPGRADE KIT OFFERS 800 DPI, FASTER PRINTING FOR HP LASERJETS UNDER WINDOWS

LaserMaster has unveiled its $995 WinJet 800 upgrade kit for Hewlett-Packard's LaserJet Series II and III laser printers. Specifically designed for greater output resolution and faster printing in the Windows environment, WinJet 800 combines a video interface card with LaserMaster's *WinPrinter* software to offer 800-dot-per-inch output resolution and full PostScript compatibility.

Eliminating the need for raster image processors and printer controller boards, *WinPrinter* software draws on the power of a 386- or 486-based host PC and Windows' multitasking capabilities, letting the CPU handle the print processing of text and graphics pages without loss of system performance. Output is sent to the laser printer via the video interface card. PostScript documents are printed in the background; fonts are downloaded automatically.

The upgrade kit supports Windows GDI direct output, PostScript, and LaserMaster's proprietary Enhanced TrueImage printer languages and is compatible with all Type 1 PostScript and TrueType fonts.

LaserMaster's WinJet 800 and the standalone WinPrinter 800 shipped just in time for evaluation. (See page 37.)

List Price: WinJet 800 upgrade kit, $995. **Requires:** 386- or 486-based PC with 8MB RAM; Windows 3.0 or later running in Enhanced mode. Supports HP LaserJet Series II, IID, III, and IIID laser printers. LaserMaster Corp., 6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-365-4646, 612-944-9330.

CIRCLE 401 ON READER SERVICE CARD

SpiderProbe Sounds the Alarm Over Networks

NEW **Spider Systems** has unveiled the Ethernet SpiderProbe B230, a new "slave" analyzer with an on-board 386 processor. The SpiderProbe works in conjunction with the existing "master" SpiderAnalyzer Version 3 series for remote network monitoring and analysis. When connected to remote segments of a network, it performs localized network and station testing, collects network and device data, and reports to the central SpiderAnalyzer, where the information is displayed and analyzed.

The unit communicates with its master station through Spider Systems' proprietary protocol and provides traffic and error statistics, network-wide and individual station alarms, traffic generation, hardware testing, packet captures, and protocol decoding. At the master station, users can set visual and audible alarms that will trip whenever the SpiderProbe

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BRIEFS

MONITORS

Radius is shipping the PrecisionColor Display/19 ($2,499), a 19-inch color monitor with two-page-view capability and a maximum resolution of 1,280 by 960 pixels when used with the Radius SVGA MultiView graphics card. The unit features .31-mm. dot pitch and 24-bit color capability. 408-434-1010.

Toshiba has unveiled the P17CU01 17-inch Flat Square color monitor ($1,700), offering .31-mm. dot pitch and 1,024-by-768 resolution. The unit features Dynamic Astigmatism Control for improved focus in the corners and stores nine preset and nine user-defined mode selections. 800-253-5249, 708-253-5249.

Seiko Instruments is shipping the CM1760LR, a 17-inch Trinitron multifrequency color monitor ($1,599). The unit supports noninterlaced resolutions from VGA to 1,280 by 1,024. The display is flat vertically and slightly curved horizontally. 408-922-5900.

Panasonic is now offering the PanaSync C1381i 14-inch color monitor ($699) with 1,024-by-768 resolution and .28-mm. dot pitch. The multifrequency monitor features a high-contrast black-matrix CRT. 908-220-7300.

Optiquest is shipping two new non-interlaced color monitors offering 1,024-by-768 resolution. The 14-inch Optiquest 1000D ($595) and the 15-inch Optiquest 2000D ($795) are compatible with VGA, SVGA, and IBM 8514/A graphics adapter boards. 310-948-1185.

PRINTERS AND ADD-ONS

Genicom is shipping the 3810S ($2,195), a single-path dot matrix printer designed for heavy-duty cycle applications such as printing continuous multipart forms or high-volume data processing. 800-443-6426.

Excellink has unveiled its new JetCard/Si line of plug-in interface cards, which allow up to 15 users to share an HP LaserJet IIISi. The base unit, the JC/Si-7 ($795) includes 6 serial ports, 1 parallel

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detects problems such as cable breaks or dead workstations, or when the network load level exceeds the user-defined threshold.

The standard SpiderProbe B230 is fully compatible with the SpiderProbe B130, Version 3, which it replaces.

List Price: SpiderProbe B230, $4,200.
Requires: Any Version 3 series SpiderAnalyzer. Spider Systems Inc., 12 New England Executive Park, Burlington, MA 01803; 800-447-7807, 617-270-3510.

CIRCLE 404 ON READER SERVICE CARD

PrinterLink and BufferPack: Printer-Sharing Solutions

NEW **GEC-Marconi** has unveiled PrinterLink and BufferPack, two new plug-and-play printer-sharing products that help to alleviate print jams, and are fully compatible with the company's AC DataLink, a peripheral-sharing device that uses existing electrical wiring to transmit data between offices.

PrinterLink is a $150 modular printer-sharing device shipped with a 128K memory buffer in each unit and designed for a daisy chain configuration. PrinterLink 1 connects the first PC to any parallel printer. PrinterLink 2 and all subsequent modules connect additional PCs to the first via RJ-type phone cable. You connect each PC to its own PrinterLink unit via the PC's parallel port and connect each PrinterLink unit with the RJ cable in stretches up to 150 feet. In this way, multiple PCs can access the same shared printer. Each 7.25- by 4- by 1.5-inch (HWD) unit has its own internal power supplies and includes 39 feet of cable. According to the manufacturer, there is no limit to the number of PCs that can be connected.

BufferPack is a modular printer-buffer add-on unit available in configurations of 256K RAM, 512K RAM, and 1MB RAM. A BufferPack can be inserted anywhere between a PC, a printer-sharing device, and a printer simply by plugging the standalone device into a wall outlet.

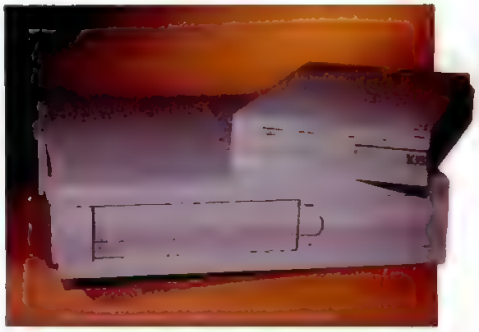
List Price: PrinterLink, $150. BufferPack with 256K RAM, $149; with 512K RAM, $199; with 1MB RAM, $299. GEC-Marconi Software Systems, a Division of GEC Avionics Inc., 12110 Sunset Hills Rd., #450, Reston, VA 22090; 800-722-2532, 703-648-1551.

CIRCLE 405 ON READER SERVICE CARD

Quantum Removable Hard Disks Secure Your Data

NEW For those looking to safeguard their data, **Quantum** has begun shipping the Passport XL removable hard disk in 50MB and 105MB configurations. Available in both external and internal (5.25-inch) designs, both Passport disks have an average access time of 9 milliseconds, an average seek time of 17 ms., and a sustained data transfer rate of 1.4 MB per second, according to the vendor.

The Passport disks are completely encased to protect stored data, and employ Quantum's proprietary DisCache and software drivers. The disk loads automatically into either chassis design, avoiding potential alignment problems. Individual components can be purchased separately.



The Passport XL 105MB removable hard disk and external chassis lets you transport your data for added security.

List Price: Passport XL 50MB hard disk, $449; 105MB disk, $629; internal chassis, $359; external chassis, $469; AT-SCSI adapter, $219. Quantum Corp., 500 McCarthy Blvd., Milpitas, CA 95035; 800-624-5545.

CIRCLE 406 ON READER SERVICE CARD

Dell Unveils Three 486 Upgradables For the Desktop

NEW **Dell Computer** has added three new desktop models to its line of upgradable 486-based PCs, including the Dell System 486P/33, which is based on a 486DX processor running at 33 MHz. The Dell System 486P/20 and 486P/25 have 486SX processors running at 20 and 25 MHz, respectively. The 486P series units feature a socketed system board designed for plug-in processor upgrades.

The new systems offer a maximum system memory of up to 64MB through Dell's 16MB SIMMs and employ flash memory storage, allowing BIOS updates via a floppy disk. Each model ships in standard configurations with 2MB RAM; 8K internal cache memory; a 50MB hard disk; a 5.25-inch, 1.2MB or 3.5-inch, 1.44MB floppy disk drive; and a VGA monitor.

List Price: Dell System 486P/20, $1,999; 486P/25, $2,299; 486P/33, $2,899. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400.

CIRCLE 407 ON READER SERVICE CARD

When It Comes To Choosing The Right Accounting Software, Who's Going To Know Better Than Your Accountant?

More Accountants Recommend Peachtree Complete.

Accountants are a pretty demanding bunch. Especially when it comes to accounting software.

That's why we find it gratifying that more accountants recommend Peachtree Complete III than any other small business accounting software.

Maybe it's because we're the people who invented PC accounting in the first place. (Back in 1980, we designed the very first accounting program for a computer called the IBM® PC.) Or because more businesses have bought Peachtree Complete than any other accounting program.

Full-Featured Accounting At A Remarkable Price.

For $199, Peachtree Complete III is the most feature-packed software you can buy. It includes nine powerful modules for the functions your company needs most: General Ledger, Accounts Payable, Accounts Receivable, Invoicing, Payroll, Inventory, Purchase Orders, Job Cost, and Fixed Assets.

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For even more accounting power, add the advanced reporting included in the Double Bonus Bundle™ or choose the multi-user capabilities of Peachtree Complete Network Accounting.™

Peachtree Supports Your Purchase, And Guarantees Your Satisfaction.

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So go ahead. Ask your accountant about Peachtree Complete. He'll probably tell you that it's the next best thing to having your own in-house accountant.

After you're convinced, see your local dealer or call PeachLine at (800) 443-9361.

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CIRCLE 358 ON READER SERVICE CARD

"EVERYONE IN THIS INDUS
QUESTION ISN'T WHAT'S IN TH

TRY MAKES BOXES. THE EM, IT'S WHO'S BEHIND THEM."

BILL HAYDEN, CHAIRMAN, COMPUADD

Face it, the history of the PC business has been something of a circus. Companies start up. Companies shut down. And along the way they're everything from incompatible to inflexible to outright unreliable.

Are you having fun yet?

If not, maybe you should consider CompuAdd. Because we do things a little differently. We design our own motherboards. We custom build systems as our customers demand. And we provide the service that's ranked #1 in a recent Dataquest® survey on customer satisfaction. In short, we do what's necessary to stay ahead of the game. And in the game. Maybe that's why we've had ten years of uninterrupted growth.

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® PC Score Report 3rd Quarter 1991

BRIEFS

CONTINUED FROM PAGE 60

port, and a 1MB memory buffer. 408-295-9000.

MicroLogic has released *MoreFonts*, Version 3.01 ($149.95), a font-generation software package offering 28 scalable typefaces in both DOS and Windows versions. Typefaces can be printed in any size and in combinations of patterns and outlines. Several special effects can be implemented. 510-652-5464.

SOFTWARE

Advanced Graphics Research is shipping *TIFFPLOT*, Version 1.2 ($249), a gray-scale raster-to-vector conversion software for use with pen plotters. Color files can be plotted as cyan, yellow, and magenta. 518-966-4600.

Linguistic Products' *PC-Translator*, Version 3.3 ($985), now handles files from *WordPerfect*, *WordStar*, and the Rich Text Format, and translates to and from English and six foreign languages. 713-363-9154.

Principia Products is shipping a new optical-mark-reading software package for processing forms such as standardized tests, surveys, and reader response cards. *Remark Office OMR* ($249.95) is compatible with most desktop scanners and runs under Windows 3.0. 800-858-0860, 215-429-1359.

Stuart-Matlock is shipping *Floppie LIBRARIAN V*, Version 5.3 ($89.95), a floppy disk inventory management software package. The program generates disk and file databases for up to 1 million floppy disks. Users can search, sort, and print reports or labels for each disk catalogued. 800-358-3475.

Fox Software is now shipping the *Library Construction Kit* for *FoxPro*, Version 2.0 ($500), offering the necessary tools to create external libraries of C and assembly language routines to be integrated into the database package. The kit includes the Watcom C8.5 compiler package. 419-874-0162.

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HiJaak Offers Four-Color Separations

IMPROVED **Inset Systems** has unveiled *HiJaak ColorSep*, Version 2.1, which combines capture and conversion utilities with color separation software. The package lets users produce four-color (CMYK) separations, including 24-bit color images, directly to film or to file. It creates 300-dot-per-inch color key alternatives using a color PostScript printer that supports transparency film media.

The package also includes the complete DOS and Windows screen-capture and graphics file-conversion utility, *HiJaak*, Version 2.1. The new version contains an optimized palette algorithm for color reductions and now supports 24-bit color in .PCX and TIFF file formats.

Buried beneath *HiJaak's* sometimes obtuse interface are powerful algorithms for converting graphic files.

List Price: *HiJaak ColorSep*, Version 2.1, $695. **Requires:** 640K RAM, DOS 3.0 or later. Inset Systems, 71 Commerce Dr., Brookfield, CT 06804-3405; 800-828-0068, 203-740-2400.

CIRCLE 408 ON READER SERVICE CARD

KnowledgePro Windows Adds Multimedia Support

IMPROVED **Knowledge Garden** has added visual design tools, access to external dynamic link libraries, and support for Microsoft Multimedia Extensions for Windows to its object-oriented programming package, *KnowledgePro Windows*, Version 2.0. The new visual tools let developers point and click on an object in the library, drop the object into a window, size it, and define fonts, colors, and styles.

Objects can be linked to external dynamic link libraries—and DLL support provides complete access to all the commands in the *Microsoft Multimedia Developers Kit*, including those for CD-ROM and stereo sound. Full-motion video boards are supported with DLL hooks. **List Price:** *KnowledgePro Windows*, Version 2.0, $249. **Requires:** 640K RAM, Windows 3.0 or later. Knowledge Garden Inc., Stony Brook Technology Center, 12-8 Technology Dr., Setauket, NY 11733; 516-246-5400.

CIRCLE 409 ON READER SERVICE CARD

Generic CADD 6.0 Enhances AutoCAD Compatibility

IMPROVED **Autodesk Retail Products** has unveiled *Generic CADD*, Version 6.0, its two-dimensional design and drafting tool. The new version lets users view, edit, print, or plot any two-dimensional *AutoCAD* (.DWG) drawing file. The *AutoConvert* .DFX file-conversion utility for exporting *Generic CADD* files to *AutoCAD*, previously sold as a separate utility, is now a standard feature.

The new version ships with a matching set of *AutoCAD*, Release 11, fonts and hatch patterns, and a new Bill of Materials generator for compiling parts lists, schedules, and cost summaries. Additional enhancements to the context-sensitive on-line help system and the package's macro customization language round out the new release.

List Price: *Generic CADD*, Version 6.0, $495. **Requires:** 640K RAM, hard disk, DOS 3.0 or later; math coprocessor and mouse recommended. Autodesk Retail Products, 11911 North Creek Pkwy. S., Bothell, WA 98011; 800-228-3601, 206-487-2233.

CIRCLE 410 ON READER SERVICE CARD

TurboTax Comes to Windows

IMPROVED **ChipSoft** has unveiled a Windows version of its popular DOS-based tax preparation software, *TurboTax*. *TurboTax for Windows* gives novice users a tutorial and explains the Help systems offering tax advice. The "Interview with TurboTax" feature guides new users to the necessary forms, schedules, and worksheets needed through a question-and-answer sequence. Experienced users familiar with the DOS version of the program can go right to the actual tax forms.

Additional features include "Consult with TurboTax," which offers in-depth context-sensitive tax information, and "Logical Next Step" pop-up windows that appear throughout the program at difficult junctures in the preparation process.

List Price: *TurboTax for Windows*, $99.95. **Requires:** 1MB RAM, hard disk, DOS 3.1 or later, Windows 3.0 or later, mouse or other pointing device. ChipSoft Inc., 6330 Nancy Ridge Dr., #103, San Diego, CA 92121-2246; 619-453-8722.

CIRCLE 411 ON READER SERVICE CARD

SORRY, HP. NEC WINS BY A TECHNICAL KNOCKOUT.

Introducing the lowest priced fully-configured PostScript® printer.

FEATURES	Hewlett-Packard LaserJet III	Okidata OL830	Texas Instruments MicroLaser Turbo	NEC Silentwriter Model 95
PostScript Language Level 2	N/A	N/A	Yes	**Yes**
LaserJet III Emulation (PCL5)	Yes	No	No	**Yes**
Automatic Emulation Switching	No	Yes	Yes	**Yes**
Enhanced Resolution Technology	Yes	No	No	**Yes**
Automatic Interface Monitoring	No	No	No	**Yes**
Envelope Feeder & Cassette	No	No	No	**Yes**
Suggested List Price	$2495	$1995	$2249	**$1749**

For more information, dial 1-800-NEC-INFO (in Canada, 1-800-343-4418). For immediate information via fax, call NEC FastFacts at 1-800-366-0476 and request #SWM95.

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THE NEC SILENTWRITER® MODEL 95

Talk about flooring the competition! Now there's a laser printer that's fully configured for both MS-DOS® and Mac® platforms... that delivers remarkably sharp output... *and* does it all at the lowest price on the market. The fact is, the NEC Silentwriter Model 95 packs more features than any laser printer in its class. Yet it starts at a price the others bargain down to! That's just plain honest. Even more important, it lets you concentrate on what counts: great output that makes you look great. Look, you know your business. Make your own comparisons. Check specs, prices, quality. Once you're ready to hand down your decision... you'll agree it's no contest.

Because ↑ is the way you want to go. **NEC**

C&C Computers and Communications

CIRCLE 217 ON READER SERVICE CARD

BRIEFS

CONTINUED FROM PAGE 64

SuperTime is shipping a new version of its sales management and telemarketing groupware package. *SuperTime* includes an appointment calendar, project and task management, and e-mail functions. *SuperTime*, Version 1.1 ($695 for four users), runs on any network operating system that complies with DOS 3.*x* file-locking protocols, such as *NetWare* and *VINES*. 416-499-3288.

Fifth Generation Systems is shipping *PYRO!*, Version 2.0 ($49.95), a DOS screen saver that includes 36 new images including lightning flashes, flying kites, and an exploding waffle iron. 504-291-7221.

Progressive Solutions' *Back & Forth Professional* ($69.95) task switcher lets users load up to 20 software programs and switch between them without exiting. The TSR program occupies approximately 33K of system memory and lets users switch between programs with hotkey combinations or mouse clicks. 212-794-9341.

Quant IX Software is shipping *Quant IX Portfolio Evaluator*, Version 4.0 ($129). The package offers investment portfolio management and stock value analysis. 800-247-6347.

The Young Software Works has released a project archiving utility for programmers working in Microsoft Visual Basic. *VP Project Archiver* ($39.95) lets you store code and form modules associated with a Visual Basic program into a single archive file through the use of popular file compression programs. 212-982-4127.

Aapex Software is shipping a cursor shape control software for Windows 3.*x*. *Cursorific!*, Version 1.1 ($49.95), lets users replace the normal arrow, I-beam, hourglass, and window resize cursors with 80 choices that include airplanes, snowflakes, and religious symbols. 800-728-7650.

AccessData is offering four password recovery programs ($185 each) for use with *WordPerfect*, *Excel*, *Lotus 1-2-3*, *Quattro Pro*, and *Paradox*. 800-658-5199.

Primavera 5.0 Redesigned for Corporate Users

IMPROVED Offering multiple project options, scheduling of up to 100,000 activities per project, and a maximum project span of 80 years, **Primavera Systems'** new release of its project management software is shipping with features that are targeted for corporate managers. Originally intended for large engineering and construction applications, *Primavera Project Planner*, Release 5.0, now includes resource management functions that allow users to define up to 16 different application profiles and specify which profile patterns should be used when allocating various resources to project activities.

Users can define custom data items to track cost, project revenue, planned starting dates, and levels of difficulty. Additional new features include a tables format that allows entry of time sheet information for resources and a custom report writer. The package supports several networks including *NetWare* and *VINES* and can import and export *Lotus 1-2-3*, *dBASE*, and *Excel* files.

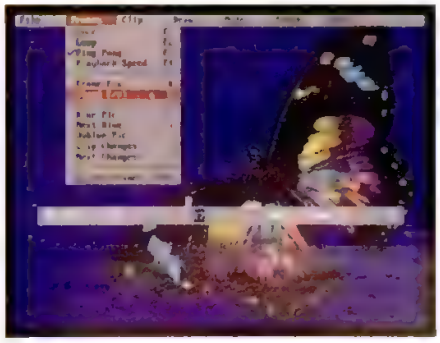
List Price: *Primavera Project Planner*, Version 5.0, $4,000. **Requires:** 640K RAM, DOS 3.1 or later. 386-based PC or better and 2MB disk space recommended. Primavera Systems Inc., Two Bala Plaza, Bala Cynwyd, PA 19004; 800-423-0245, 215-677-8600.

CIRCLE 412 ON READER SERVICE CARD

PC Animate Plus Makes Animation More Affordable

NEW *PC Animate Plus*, a $199.95 two-dimensional paint-and-animation package developed by **Presidio Software** and distributed by Brown-Wagh as a part of its Multimedia Recipe, is now shipping. The 8-bit color program lets users combine text, graphics, and sound (when used with Creative Labs' Sound Blaster audio board) to create animation.

The package's paint and drawing tools use a palette of 256 colors and offers frame, pixel, sound, and palette animation techniques. Special-effects features include frame rotation simulating a three-dimensional appearance, pixel manipulation, and texture application. *PC Animate Plus* uses a proprietary file format but can import .GIF, .PCX and TIFF files.



***PC Animate Plus* simulates animation by playing a series of graphic image frames at high speed.**

List Price: *PC Animate Plus*, Version 1.0, $199.95. **Requires:** 640K RAM, DOS 3.2 or later, mouse, Creative Labs' Sound Blaster audio board. Brown-Wagh Publishing, 130-D Knowles Dr., Los Gatos, CA 95030; 800-451-0900, 408-378-3838.

CIRCLE 413 ON READER SERVICE CARD

BFS Unveils Updated Batch Forecasting System

IMPROVED **Business Forecast Systems** has added reporting features, more file formats, output options, and the ability to handle missing data to *Forecast Pro Batch*, Version 1.1. Commands are executed from a script file containing the data to be forecasted and from optional user-defined forecast settings.

Univariate (.UNI and .KEY) and multivariate (.MLT) ASCII file formats as well as .WK1 files are supported. Additional features include exception reports, forecast bias monitoring, and a forecast evaluation option that withholds data at the end of each series, checking forecasts against actual values.

List Price: *Forecast Pro Batch*, Version 1.1, $3,995. **Requires:** 640K RAM, hard disk, DOS 2.0 or later, math coprocessor. Business Forecast Systems, 68 Leonard St., Belmont, MA 02178; 617-484-5050.

CIRCLE 414 ON READER SERVICE CARD

Documentation Blueprint Creates Reference Manuals

NEW **Comprose** is shipping a three-module documentation publishing kit. *Documentation Blueprint*, Version 1.0, is designed to let users create reference documentation. The *A-Z Methodology* module consists of a manual and a series of forms that are designed to provide a framework for documentation production.

Project Management Toolkit and *Page Templates* provide the software for project tracking and a collection of stylesheets and templates for use with such programs as *PageMaker* and *WordPerfect*. ■

List Price: *Documentation Blueprint: A-Z Methodology*, $249.95; *Project Management Toolkit*, $129.95; *Page Templates*, $129.95; $389.95 for all three modules. **Requires:** 640K RAM, DOS 2.1 or later. Comprose, Barrett Office Dr., #109, St. Louis, MO 63021; 800-348-8211, 314-966-8833.

CIRCLE 415 ON READER SERVICE CARD

What a racket!

$3,000 bucks for a CAD program? Are you kidding?

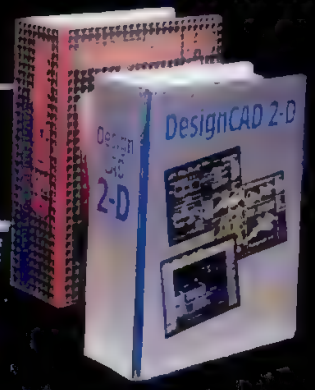
DesignCAD 2D is only $349, and it has more and better features than the other CAD programs that cost $3,000!

And, if you're ready for a three dimensional CAD program, there is the state-of-the-art DesignCAD 3D . . . for only $499!

DesignCAD is the software used in the design of Andre Agassi's tennis rackets, the Patriot missile, and scores of other high tech, low tech, and no tech products.

So what's all the racket about? It's because we believe that it's silly to spend more on a CAD system than you would on a word processor. Agree? Well, the ball's in your court.

Your product designed with DesignCAD? Let us know, and maybe we'll put it in one of our ads.



For a *free* demo disk and 16 page color brochure, contact:

American
Small Business Computers, Inc.
One American Way • Pryor, Oklahoma 74361
(918) 825-4844 • FAX (918) 825-6359

European Headquarters:
102 Rue La Fontaine • 75016 Paris, France
Phone 331 4520 6540 • FAX 331 4520 6539

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BUYERS ASSURANCE SEAL

CAD/CAM Software

PC MAGAZINE December 11, 1990

PC MAGAZINE

Also Available for Macintosh

How Can Northgate® Offer You A 386™/33 Color System And Unequalled Support For Only $2399?

Like The Nazca Lines, Some Phenomena May Never Be Explained.

Today, like in ancient times, it takes great vision, teamwork and commitment to create something that is truly phenomenal. This is precisely the spirit behind the Northgate 386/33.

Long before Northgate entered the 386 market, countless hours went into the creation of systems that offer unparalleled performance and reliability. That effort was rewarded as Northgate's 386 systems captured three *PC Magazine* Editor's Choice Awards, three *Computer Shopper* Best Buy Awards and several *InfoWorld* recognitions.

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CODE A3005

edited by
Carol Levin

Read Only

Reviews of the Latest Books for the PC User

Windows Columnist Explores Secrets Of Microsoft's Graphical Environment

Beneath Windows' friendly GUI interface is a subterranean maze of treasures that few Windows users explore. This cavern is filled with anomalies that even fewer users understand. Brian Livingston, *InfoWorld*'s Windows Manager columnist, takes the mainstream Windows user on an illuminating journey through undocumented (or poorly documented) features, unique turbocharging techniques, and workaround solutions in his book *Windows 3 Secrets*.

Livingston's spelunking begins with an exploration of ways to customize and optimize the Windows environment, including step-by-step instructions for personalizing the Windows boot-up screen. He then digs up little-known information about Applets (File Manager, Control Panel, and so on), *Word for Windows*, and *Microsoft Excel*.

Entertaining finds include Windows and application "gang screens," the hidden credits of the program's creators. Over 100 pages thoroughly cover the dos and don'ts of working with DOS apps under Windows. Unfortunately, Livingston sidesteps Windows' dynamic data exchange (DDE), an area even he admits is prone to quirks.

More than a third of *Windows 3 Secrets* examines the vast cavern of Windows and PC hardware compatibility issues. The author chips away at the many anomalies that arise when using Windows with various hardware and network products. His extensive coverage includes brand-name BIOSes, PCs, hard disks, keyboards, mice, modems, monitors, networks, printers, and video boards. The chapter on using Windows on a network is a gold mine of previously hard-to-find information.

Following his hardware explorations, Livingston maps out Windows installation, configuration, and optimization, including disk caches, RAM disks, swap files, memory managers, and configuring DOS 5 for Windows. A convenient listing briefly describes the almost 200 settings in Windows' WIN.INI and SYSTEM.INI files.

Livingston's expedition ends with documentation for the treasure trove of 36 Windows shareware programs bundled with *Windows 3 Secrets*. The two disks include utilities for file and program management, image processing, graphics file conversions, file compression, screen capturing, text searching, communications, creating Windows batch programs and games, and more. The disks lack an installation program, though, and it's tedious to decompress and install all the programs manually.

Sure-footed explanations, recommendations, and concise hands-on instructions give Windows users new depths of mastery over their environment. This guide is so packed with gems that users will find themselves going back again and again to explore Windows' secrets.—*Brent Heslop and David Angell*

Windows 3 Secrets
by Brian Livingston, $39.95, IDG Books, 155 Bovet Rd., San Mateo, CA 94402; 800-282-6657.
ISBN: 1-878058-23-1.
CIRCLE 469 ON READER SERVICE CARD

FoxPro 2.0 Developers' Guides Teach Database Designs that Relate

FoxPro's blazing speed and slick development environment have made it a programmers' favorite, but the feeding frenzy to produce *FoxPro* end-user books has resulted in little worth mentioning. There are, however, two developers' books worth considering that offer a selective rather than comprehensive approach to programming in *FoxPro*.

In *Developing FoxPro 2.0 Applications*, authors P.L. Olympia and Kathy Cea start by rehashing the new features in *FoxPro* 2.0—material better left to reviewers and *FoxPro* advertisements. This might give you the impression that it's a quick-fix update of a Version 1.0 book, but that's not entirely true. The authors proceed quickly to ideas and insights for developing database applications. Chapters specific to *FoxPro* 2.0 cover template processing, SQL, and the external application program interface (API), with additional 2.0 material spread throughout the book.

The authors also examine important topics such as database design, program organization, indexing and sorting, reporting and printing methods, and date- and time-handling techniques. Two chapters on multiuser programming cover network issues, and low-level file I/O and memo field techniques also get special attention.

Since Olympia and Cea relied on a beta version of *FoxPro* 2.0, some of the material in *Developing FoxPro 2.0 Applications* is incorrect. For example, the extended version of *FoxPro* does not support 125 work areas, as the book suggests. And some of 2.0's new programming tools, which essentially redefine the way you program in *FoxPro*, are mentioned only briefly. Nonetheless, the authors are experienced practitioners who offer *FoxPro* developers a range of useful material, from database design to a selection of topics related to developing *FoxPro* applications.

By its title, the second book—*FoxPro 2: A Developer's Guide*—might lead you to believe that it's a thorough step-by-step guide to developing *Fox-Pro* applications. Instead, this collection of 18 chapters written by nine different authors is far more general than the title suggests.

As with many anthologies, you'll likely find that some of the material isn't for you. For example, one chapter dealing with user interface design is actually a reprinting of a chatty debate that took place on CompuServe.

Fortunately, several of the chapters are worthwhile. The one on LANs does a great job of covering the many issues involved in multiuser programming with *FoxPro*. Add in solid chapters on the relational model, relational programming in *FoxPro*, and programming *FoxPro*'s external application program interface (API), and you have the makings of a good book.

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FoxPro, both of these titles merit consideration: the anthology *FoxPro 2: A Developer's Guide* for its mix of *FoxPro*-specific and general database information; *Developing FoxPro 2.0 Applications* for its material geared to *FoxPro* specialists.
—*Sal Ricciardi*

Developing FoxPro 2.0 Applications

by P.L. Olympia and Kathy Cea, $26.95, Addison-Wesley Publishing Co., Jacob Way, Reading, MA 01867; 800-447-2226, 617-944-3700. ISBN: 0-201-56786-5.

CIRCLE 470 ON READER SERVICE CARD

FoxPro 2: A Developer's Guide

$29.95, M&T Books, 411 Borel Ave., San Meteo, CA 94402; 800-533-4372, 800-356-2002. ISBN: 1-55851-083-4.

CIRCLE 471 ON READER SERVICE CARD

Desktop Publishing in Color: Tools and Theory that Make It Work

How can you get red when you want red? Author Michael Kieran explains how in *Desktop Publishing in Color*, a complete resource that both beginners and conventional publishers looking to make the jump to DTP can turn to. The book provides expert guidance in general color theory, as well as practical knowledge of color printing, hardware, software, and peripherals.

Kieran casts a wide net and covers many issues—from screen frequency to prepress system components—with clarity and accuracy, though not in great depth. He defines all the buzzwords and explains the fundamentals, including the RGB, CIE, CMYK, and Pantone color models, color separations, the halftoning process, and color scanning technology. He also looks into working with color thermal printers, slide film recorders, and service bureaus. Many of the topics are accompanied by excellent illustrations and technical diagrams.

Along the way, *Desktop Publishing* tends to lose balance. Kieran devotes considerable attention to *Adobe Illustrator* and *Aldus FreeHand* but shortchanges equally important programs such as *Arts and Letters*, *CorelDRAW*, and *Micrografx Designer*. Although he acknowledges the impact of Windows 3.0 on the desktop publishing marketplace, Kieran doesn't provide much information about this burgeoning environment. And areas of confusion in the color publishing industry, such as OPI (Open Prepress Interface) and DCS (Desktop Color Separation), deserve the same detailed coverage of specifications and applications and the same level of know-how that Kieran provides for color trapping in *QuarkXPress* 3.1.

Although this roller-coaster, superficial-to-highly-detailed treatment of issues may leave you wanting more, Kieran does deliver on his promise of providing a factual catch-all on electronic color publishing for the 1990s. When you're ready to venture beyond this overview, *Desktop Publishing in Color*'s bibliography and listing of publications and associations provide the directions.
—*Gerard Kunkel* ■

Desktop Publishing in Color

by Michael Kieran, $26.95, Bantam Computer Books, 666 Fifth Ave., New York, NY 10103; 800-223-6834, 212-765-6500. ISBN: 0-553-35140-0.

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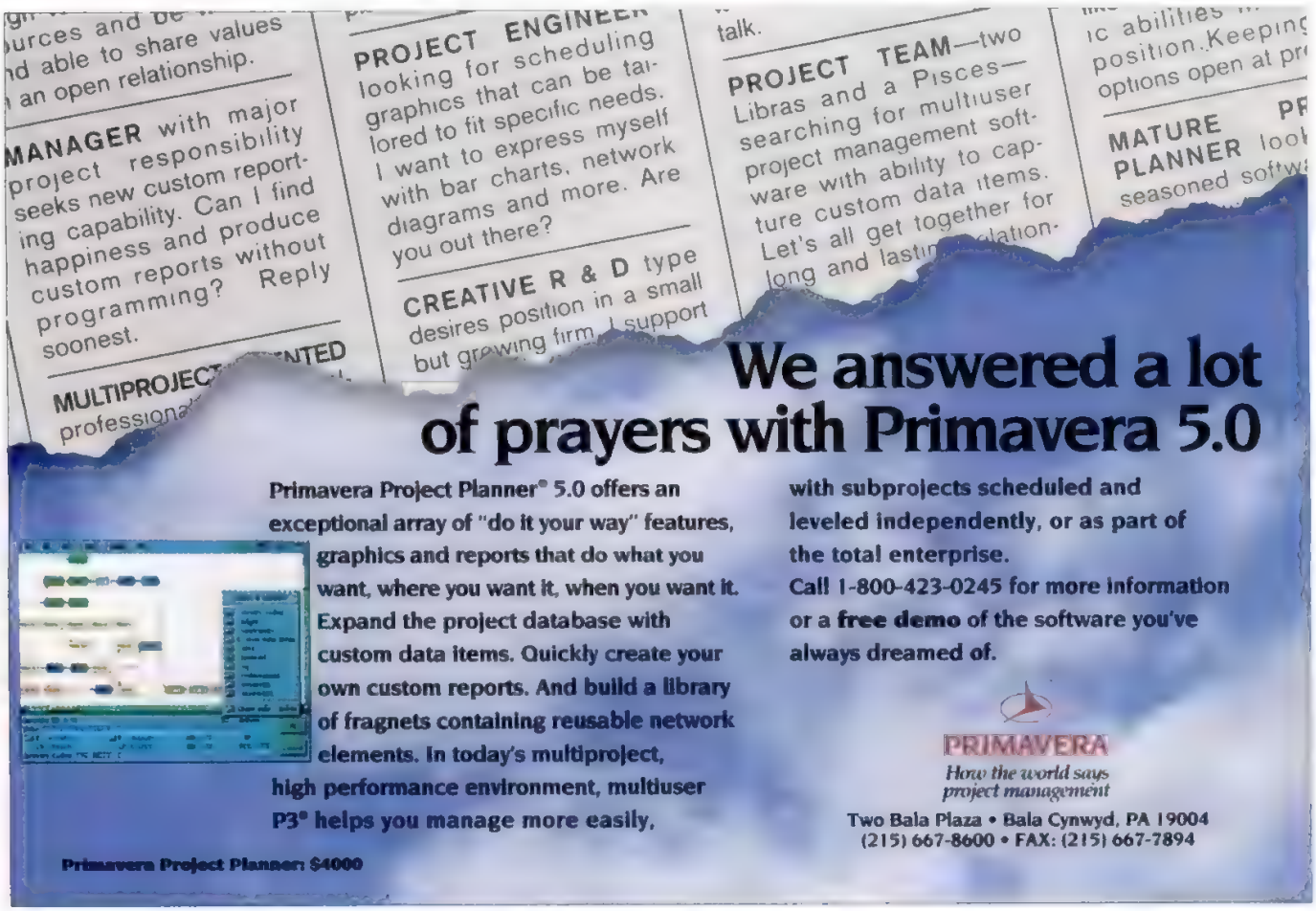

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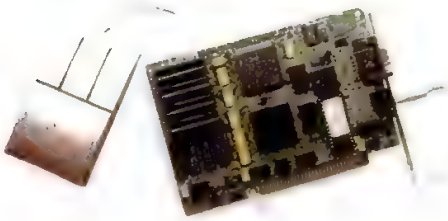

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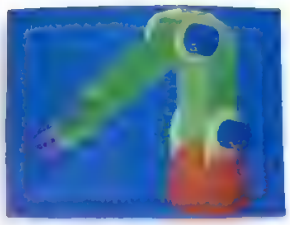

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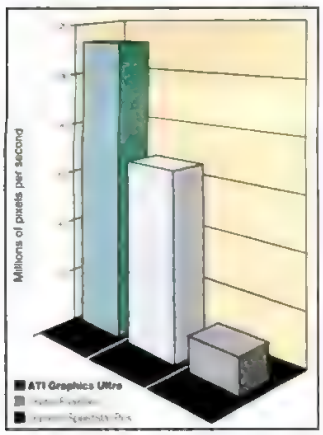

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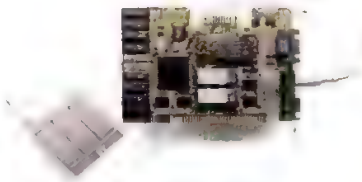

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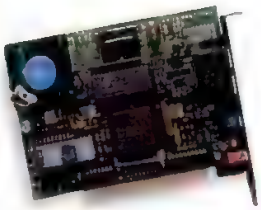

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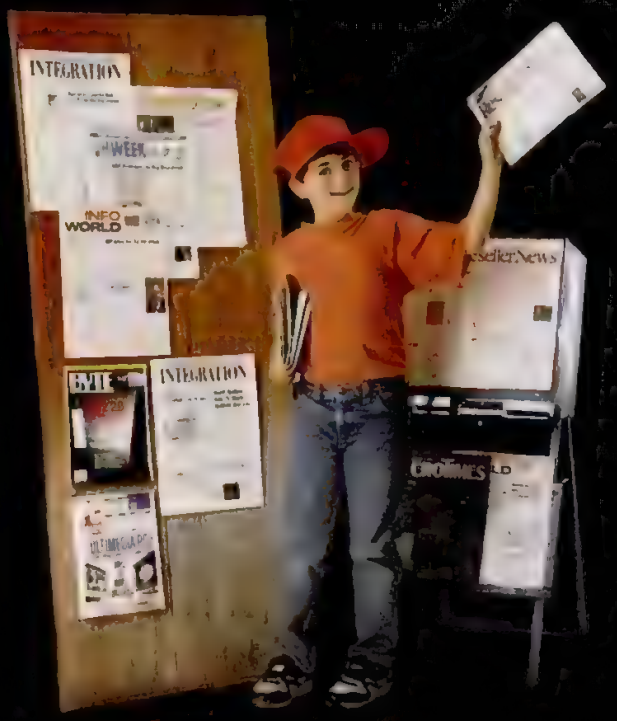

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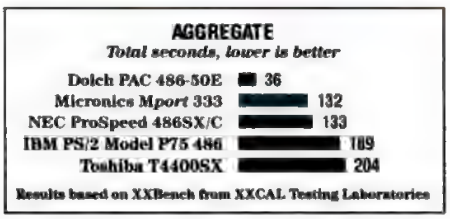

The results stand. More words would be futile.

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CIRCLE 087 ON READER SERVICE CARD

edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

Periscope/EM: Debugging with No Impact on Runtime Environment

When you debug software, one problem you face is how to duplicate the runtime environment. If your debugger is taking up system memory and forcing your application to load at a different address than it normally would, you've changed the execution environment. This is one reason why major debugger vendors are finding new ways to keep their tools out of the lower 640K memory region. One such vendor, The Periscope Company, has just released a product, Periscope/EM, Version 5.0, that does just that.

The product, which is well suited to many types of system-level debugging tasks, is a software-only release that solves the memory intrusion problem through a joint effort with Qualitas, makers of *386MAX* and *BlueMAX* memory management software. As a result, with either *386MAX* or *BlueMAX* (Version 5.11 or later) loaded on your PC, Periscope/EM uses no memory whatsoever in the lower 640K. Instead, the software uses about 300K of extended memory mapped into a 32K swap region of high memory between 640K and 1MB. This leaves more room for debugging larger programs and minimizes Periscope's impact on the runtime environment. In addition, Periscope, through *386MAX*, uses the CPU's memory protection features to write-protect the debugger's memory during debugging. That way, a runaway program cannot overwrite the debugger.

For a long time the company has made available an alternative solution, called the Model I board, which provides write-protected memory for running the debugger outside of the lower 640K. Unfortunately, the Model I requires a free expansion slot.

In order to provide a software-only solution, Bob Smith from Qualitas and Brett Salter from Periscope worked together to implement a memory-swapping interface in *386MAX* and *BlueMAX* equivalent to the one used with the Model I board. The result? QPMS, the Qualitas/Periscope Memory Specification, which is being implemented by other memory management vendors as well.

Using QPMS, Periscope/EM swaps from high memory to extended memory through *386MAX* or *BlueMAX* instead of swapping from high memory to the memory on the Model I board. There are several advantages to this approach. For one, Periscope executes much faster, because it's running from fast 32-bit memory instead of paging to the 16-bit memory on the Model I board. In addition, *386MAX* provides much greater flexibility with regard to where to locate the 32K swap region. But the biggest advantage, of course, is that now you can have Periscope's superior debugging capabilities available without the hassles of installing and configuring a board and dedicating a slot in your computer, and without infringing on your lower 640K.

However, you may still want to purchase the Model I board for its ROM-scan capability. This lets you set up Periscope so that you can get control when the system boots, during ROM scan.

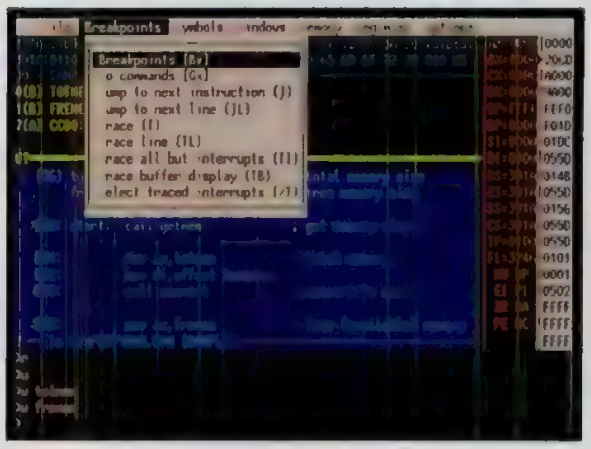
Periscope is well suited to all sorts of system-level debugging tasks. For example, you can trace through DOS or the BIOS and see exactly how they work. And Periscope makes it easy to debug TSR programs, device drivers, and interrupt handlers.

The product supports a number of breakpoint types, some of which support the 80386 debug registers for real-time breakpoints. You can trace and step through your code using three disassembly modes. First, there's assembler only, which shows your program in full Intel 808*x* detail. Then, there's a mixed mode, which shows both assembler and source. And finally, there's source code only. You can also open a watch window to watch the contents of up to eight memory locations or I/O ports. A register window lets you keep an eye on the CPU registers. You can save the register values and later compare them with the current values, and Periscope will highlight those registers that have changed. This can be very handy for deciding which registers to push and pop.

You can also use Periscope to debug programs written in high-level languages. For example, full source-level and symbolic debugging support is provided for language products from Microsoft and Borland, among others.

Version 5.0 includes an optional pull-down menu system that makes it much easier to remember and find commands. Also included is support for two symbol tables, which can be useful for debugging a mainline program that communicates with a TSR, for example. You can load one symbol table for each and switch between them.

If you pride yourself on knowing what's *really* going on in your machine, you'll find Periscope a handy tool to have around.
—*Sal Ricciardi* ■



Periscope/EM's new pull-down menu system makes debugging much easier because you don't have to memorize all of the commands.

Periscope/EM, Version 5.0
List Price: $295. **Requires:** 386SX or better, 300K extended memory and 32K high memory between 640K and 1MB, Qualitas's *386MAX* or *BlueMAX*, Version 5.11 or later, DOS 3.0 or later. The Periscope Company, 1197 Peachtree St., Atlanta, GA 30361; 800-722-7006, 404-875-8080.

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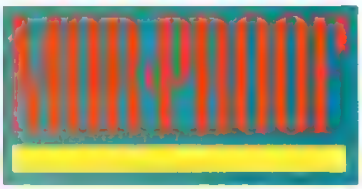

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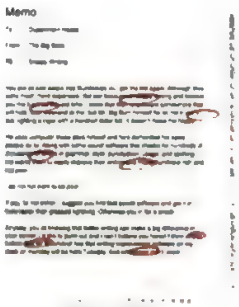

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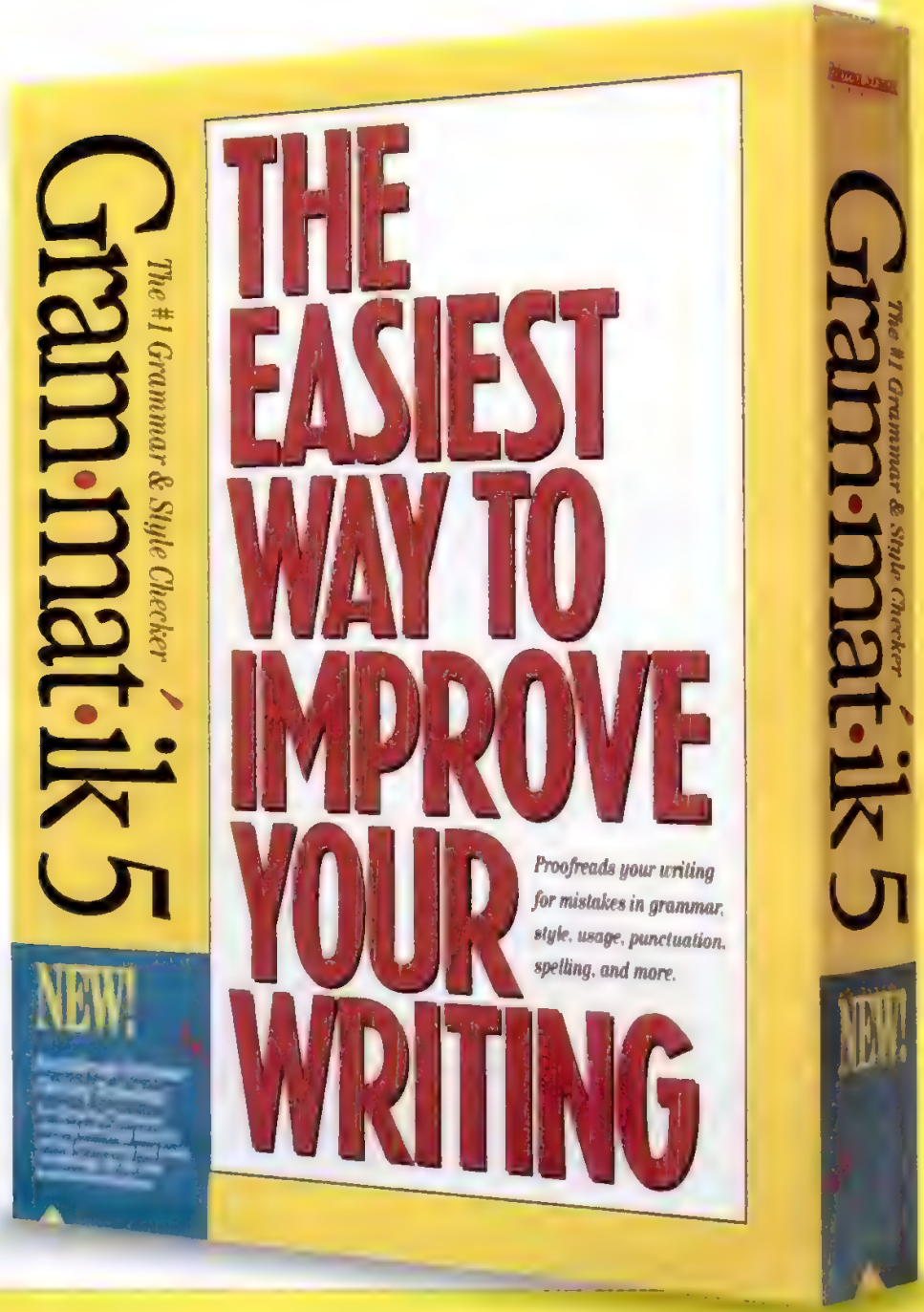

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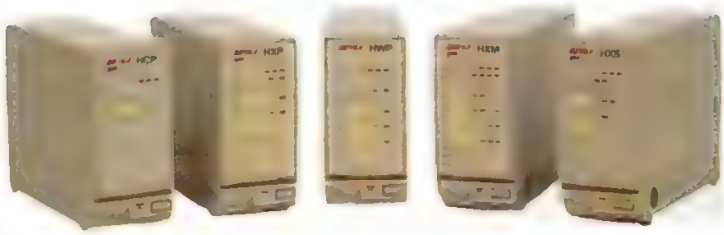

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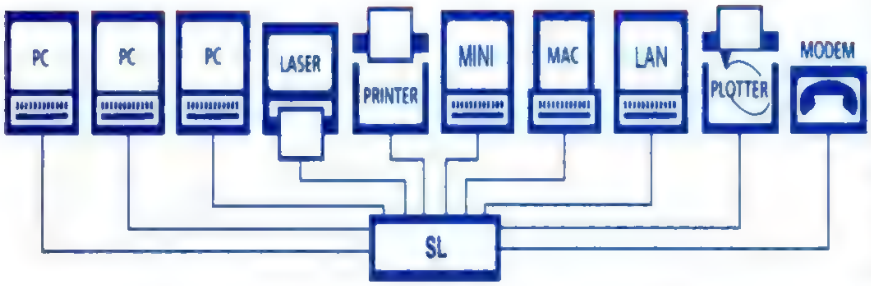

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Michael J. Miller

Multimedia: Pong for the Nineties

A few years from now, we'll look back at the earliest multimedia applications and wonder how we ever put up with them.

Do you remember *Pong?*

Pong was the first video game. Nolan Bushnell invented it and founded a company called Atari that took the world by storm in the Seventies. In retrospect, *Pong* didn't do a whole lot. You could move a paddle up and down and hit a ball across a net, where you played either another player or the computer. For practice, there was handball, where you simply bounced the ball against a wall. Let's face it, *Pong* was fun, but it wasn't any *Super Mario Brothers 3*.

I was reminded of *Pong* while trying out some of the new multimedia software. By now, you've probably heard more than you care to about multimedia software, but you can't understand how compelling the concept is until you've actually worked (and played) with some of these programs.

Most of the really good multimedia packages I've seen so far are CD-ROM–based applications that meet the MPC specification. Essentially, that means these packages run under Microsoft Windows with Multimedia Extensions and require a sound board.

One of the most impressive is Microsoft's *Multimedia Beethoven: The Ninth Symphony* (which I discussed in "Multimedia: Seeing Is Believing," December 17, 1991). With its ability to show you the structure of the symphony, let you jump from part to part, and show you the notes while playing the music, it's the best way of learning about symphonic music in general and Beethoven's Ninth Symphony in particular. I'd be surprised if this kind of software doesn't significantly change the way people learn about classical music.

While *Multimedia Beethoven* is innovative in its use of multimedia technologies, we've seen many reference programs that use relatively conventional practices but still reveal some of the power behind the concept.

Microsoft Bookshelf for Windows is a fairly tame collection of standard reference books, livened with a few neat animations and the actual voices of e e cummings, Dylan Thomas, and John F. Kennedy. The subject material becomes really compelling when you hear Dylan Thomas recite his verses as opposed to sitting there and reading the text on-screen yourself.

Similarly, *Compton's Multimedia Encyclopedia for Windows*, from Britannica Software, presents a solid set of encyclopedic references that makes learning much more accessible by including animations of the pumping heart and the first moon walk, punctuated with Neil Armstrong's "That's one small step for man" speech. This kind of "media" lends an air of immediacy that really doesn't come across in most on-line software. It's the sense of being there that those of us who grew up with television (and certainly our children) expect after years of watching the evening news.

You don't even need a CD-ROM drive to experience multimedia. *Knowledge Adventure* is a wonderful software package that lets you choose different scenes from history, art, and science by picking a place on a map or a date on a time line. This ingenious package uses sophisticated compression schemes to pack text, images, and sounds (but not animations) into a program that fits in 6MB on your hard disk. *Knowledge Adventure* is not a small program in terms of its requirements, but it brings considerably more life to the subject than text-only history programs.

PHOTOGRAPHY: THOM O'CONNOR

Packages like *Knowledge Adventure* are maturing the field of multimedia software.

MAKING CONNECTIONS

In addition to graphics, sound, and animation, part of what makes these applications so inter-

esting is their use of "links," which let you easily jump around from subject to subject. For instance, in *Compton's Multimedia Encyclopedia*, you can see lists of related topics and easily move from one listing to another. In *Knowledge Adventure*, by clicking on the main image on-screen, you jump to some related topic, which can have some surprising twists and turns. For instance, I quickly moved from a musical entry to a discussion of the phonograph, to Edison's invention of the electric light, to Bell's invention of the telephone, to Count Alessandro Volta, who built the first battery.

Such links give the person using the program a considerable amount of control over the order in which things happen. Simply put, these links let you learn what you want to learn.

Such links have appeared in all sorts of programs over the past few years, notably Apple's *Hypercard* and Asymetrix's *ToolBook*, all of which seem to build on computer guru Ted Nelson's concept of hypertext. But it's only when you add graphics, animations, and sound that these links become particularly compelling.

Multimedia programs with lots of linking possibilities will be a great supplement to traditional books, which of course are very linear in their approach. They make gathering reference material quite easy; they also make learning fun. I wouldn't want to see such nonlinear materials become the only standard, however; the very "hit-and-miss" nature of the process that makes it fun also makes it too likely to miss something important.

Still, there are times when linking comes in very handy. I can see young children marveling at their control of characters in games such as Voyager's *Amanda Stories*. On this CD-ROM, based on Amanda Goodenough's children's books, your little one can direct the pace and direction of the various episodes featuring Your Faithful Camel and Inigo the Cat. By pointing and clicking at different objects, children control the action, initiating various animations and sounds.

ONE SMALL STEP FOR MULTIMEDIA

All of this sounds great, but you have to wonder whether the existing technology can really live up to people's expectations. The youngest children may not mind waiting a few seconds for the next frame in a CD-ROM–based game, and no one will object to waiting for information to appear when searching a reference program, but I'm not convinced that the MTV generation is ready to wait. They will expect instantaneous state-of-the-art graphics and sound.

And you know what? They'll get it. Not this year, but soon. Because the more I look at the first few multimedia titles, the more I'm convinced that we need faster processors, faster video, more storage, and better drives. And we'll get them, too. Don't worry, the technology is on the way.

I won't be too surprised if, at the end of the decade, we look back at things such as *Amanda Stories* and *Multimedia Beethoven* and think about how primitive they were. After all, that's how we view *Pong* these days. ■

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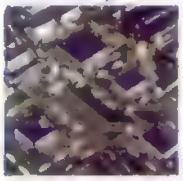

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Bill Machrone

My friends, we are here to honor the 386. It was a good ally, a stalwart companion. It took us into the world of 32-bit computing. It stood by us while we tinkered with 16-bit operating systems and 8-bit I/O. It didn't laugh at our applications, few of which ever tested its mettle.

As we move forward into the more progressive world of the 486, with its pipelining, coprocessing, superior bus utilization, and above all, indefatigable upgrade strategy, we'll take solace and comfort in knowing that the heart of the 386 beats proudly (and faster) in its progeny. May it rest in peace.

The 386 Is Dead

The 386 is about to take its place in history alongside the 286—a good idea, but a bad investment. What do they know that you don't?

By now, you've already concluded that my eulogy for the 386 is premature, wrong-headed, and obnoxious. Thank you. But if you're making purchasing decisions for yourself, your company, or your friends, there are a few things you should consider very carefully before you buy another 386: the price, the performance, and the future.

PRICE

The 386 lacks many things, and chief among them is a price advantage. Today, anybody who wants to charge you more than a couple of hundred dollars extra for a 486SX-based PC is ripping you off. Chips and Technologies is trying to change that. Its recently announced SuperState 386 chip set is aimed squarely at the $1,000-and-below market. It's not here yet, but in six months, the 386 will be the cheap personal computer of choice. Does that sound like something you want to build your future on?

PERFORMANCE

The 33-MHz 386 has nothing to apologize for when it comes to performance—except that it does a lot of things worse than a 486. It uses too many bus cycles, demands more memory, lacks internal memory caching, and is dim-witted about the way it talks to the math coprocessor. All of these inherent problems with the 386 can be fixed. Intel's fix is called the 486. Everybody else's fix is called the 386-something-or-other. Why would you want to live in the past?

Of course, there's an active discussion taking place as I write this: Which is faster, the 386/33 or the 486SX/20? Intel says the 486SX is 10 percent faster. PC Magazine Labs says it's 10 percent slower. I say, enough already. They're both fast and most users can't see the difference. The real differences come when we take the 486 to 50 and 75 MHz. We're looking at CISC performance that's giving the RISC developers fits. 386 chips need not apply.

THE FUTURE

The 386 doesn't have one. Okay, it'll be a year, maybe more, before 486s start outselling 386s. It's inevitable, though, so why would you want to delude yourself by pretending otherwise? More to the point, the 486 has a clear upgrade path, both to the double-clocked chips (those that run twice as fast internally as they do externally) and to the 586. You'll plug upgrades into the processor enhancement socket on 486SX machines. With 486DX models, you'll be able to replace your 486DX chip directly with a double-clocker or a 586.

But Intel isn't stopping there. It's asking manufacturers to include an empty socket on all future 486 motherboard designs, the better to accommodate future CPU upgrades. Yes, you can accomplish the same thing today with an upgradable machine featuring interchangeable processor modules, but then you're dependent on the computer manufacturer to engineer a new module—and to stay in business, for that matter. And the module will always cost more than the chip.

ILLUSTRATION DAVID TURNER

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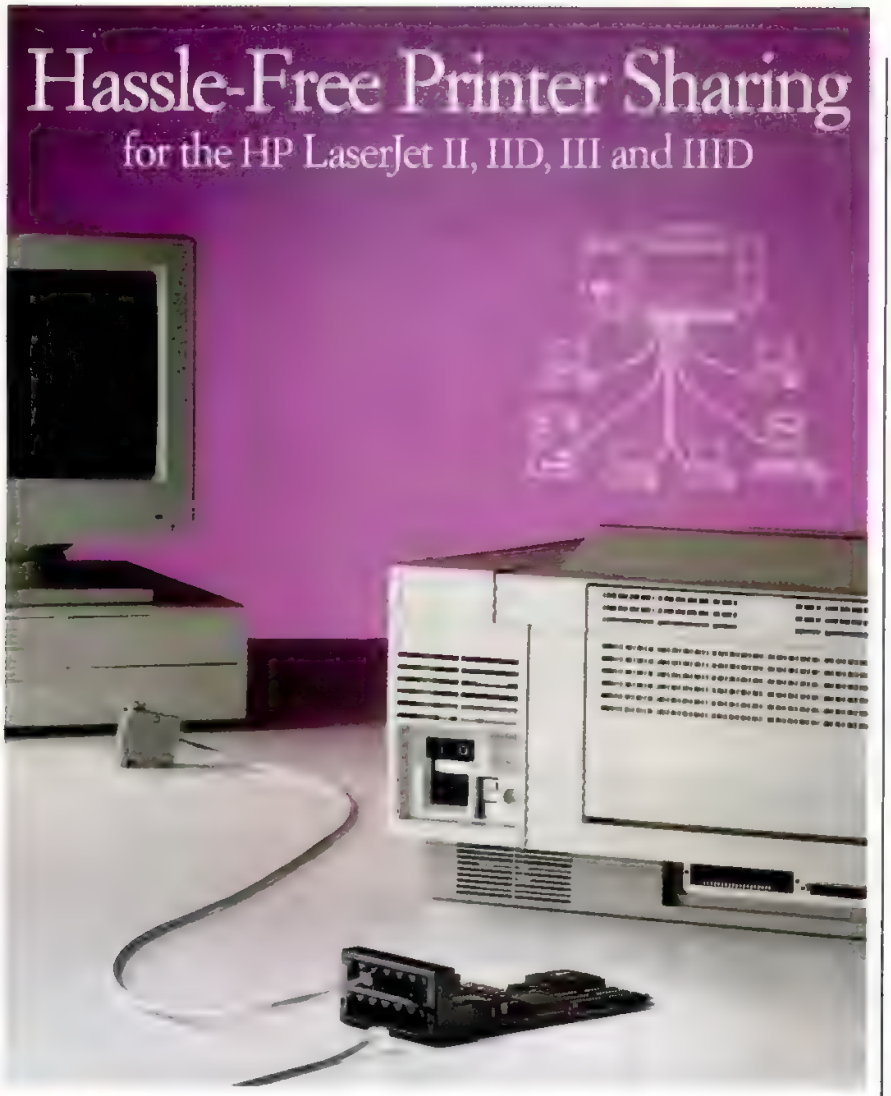

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we declared it dead more than three years ago, the 286 has nearly claimed another victim. The 286's first victim, of course, was OS/2. The fateful IBM/Microsoft decision to build OS/2 for the 286 has been well chronicled. It probably had more to do with OS/2 1.*x*'s failure than the operating system's early positioning as the replacement for DOS, because it was a nearly impossible task to build all of the desired functions into OS/2 and run it on that brain-damaged chip. The jury is still out on OS/2 2.0; I'm mildly optimistic, but I'm also content to wait and see. At least it's real 32-bit code.

The 286 extracted a terrible price from IBM, too: technological leadership of the personal computer industry. Never mind that IBM was blindsided by Compaq's Deskpro 386. For years it continued to be content with a product line that was soft around the middle with underperforming 286 machines.

IBM thought it heard its customers saying, "We don't need no steenking 386," when they were really asking the company for leadership. IBM could point to its robust 286 sales, utterly missing the point that it offered neither cost benefits nor technical reasons for moving up to a true 32-bit processor. IBM trained its customers to think of some other—any other—vendor when they wanted a state-of-the-art machine.

A DISASTER READY TO HAPPEN

The recent near-victim was multimedia. The MPC standard says that a 286 is the minimum configuration. Fortunately, nobody listened. Nearly all manufacturers agree that a 20-MHz 386SX is the real minimum processor, and IBM, bless 'em, even went beyond that with a custom version of the 386SX, complete with on-board cache. A spate of 286-based multimedia machines would have been sure death to the emergent standard, or would have set it back by six months or a year. The buyer's confidence is hard to win back once it's been lost.

You can't discern any of this when you're in the middle of it, only after the fact. But those who don't study history are condemned to repeat it. I'm sure there's a 386-based disaster out there somewhere, just waiting to happen. Don't let it happen to you. ■

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John C. Dvorak

Microsoft's Worst-Case Scenario

A successful release of OS/2 2.0 would not only do wonders for IBM, it could spell doom for Microsoft.

We'll soon know whether IBM's OS/2 will be able to knock Windows and DOS from the top of the hill. The likelihood is almost nil, since popular support for Windows seems to have reached critical mass; its position as the operating system of the future seems secure. Microsoft is even planning to take whatever OS/2 code it has developed as part of its rumored "portable OS/2" and roll it into a grand Windows operating system called Windows NT. This Windows will be a standalone product not requiring DOS, and it will do everything OS/2 can, but with the Windows cachet.

But the game isn't over. You can be sure that Microsoft plans to stave off any last-ditch attempt by IBM to retake its former position of leadership. Microsoft is discussing the dread worst-case scenario: that OS/2 becomes a popular success in 1992. While most observers laugh at the notion, OS/2 diehards are lurking in the wings, hoping to be able to say, "I told you so!" Sure, it's a long shot, but anything is possible.

I'm reminded of an article that appeared in *The Wall Street Journal* back in March of 1989. It quoted estimates from Sanford C. Bernstein & Co., which predicted that in 1993 Unix will be the dominant PC OS, with 45 percent of the market, leaving OS/2 with 25 percent and DOS with 17 percent. Two years later, Unix is not much discussed by desktop users, Windows has taken off like wildfire, and OS/2 hopes for some attention. Meanwhile, DOS dominates. I doubt seriously whether much of this will change by the 1993 time frame. (So much for the expertise of the analysts.)

My point isn't that the bonehead prediction is going to be off the mark, but that Windows has become an overnight phenomenon. I mean, it wasn't even mentioned in the percentages, and now it's a tremendous success.

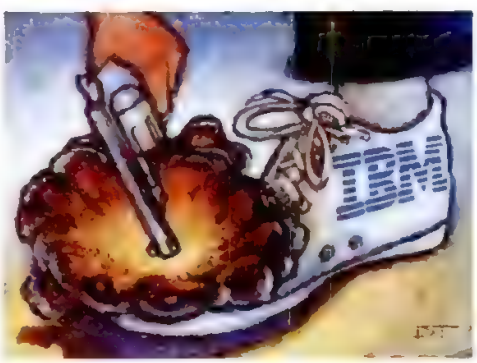
So we might be in for another surprise. Windows has been out for a year, and it's brilliant. Why can't history repeat itself and turn the boom to bust by countering with another phenomenon? Microsoft itself didn't expect such a sudden groundswell when it rolled out Windows 3.0. It's possible that IBM can create the same phenomenon.

The joke is that IBM is still too stuffy a company to generate the kind of user enthusiasm achieved by the team at Microsoft. It will take more than a quality product to move people to OS/2. The best IBM can hope for is a few good reviews and a cult following. Still, this is just my opinion as I sit behind a desk. My future isn't involved, so I can pontificate. Microsoft cannot take such a position. It has to have a plan.

Microsoft representatives have insincerely claimed that they really don't care if OS/2 is a success or not, because Microsoft has market rights to OS/2. It can make money selling OS/2 as easily as it can sell Windows.

In a pig's eye. Microsoft will do everything it can to quash OS/2. Its corporate personality could never tolerate IBM lording over it with a successful OS/2 and controlling the direction of operating systems.

The key, though, is whether Microsoft can remain calm during this crucial period. The best strategy is not to bad-mouth, condemn, or ridicule either IBM or OS/2. Microsoft must ignore them and rise above. If Microsoft panics and exhibits its bad side—an immature but cocky teenlike corporate arrogance highlighted by rude gloating—then users will revolt and look seriously at OS/2. That could spell doom for Microsoft. If Microsoft stays cool and lets IBM do what it does best—shoot itself in the foot—then Windows will rule the day (and 1992).



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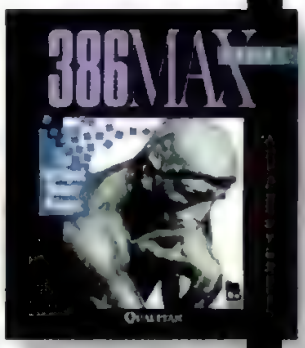

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Inside Track

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I've already received one such postcard with what on first glance appeared to be a handwritten address and personal note. Careful examination revealed a laser-printed typeface given away by a curious exactness to the handwriting; every capital *F*, for example, was identical. Still, only a few people would notice that this was actually a personal font using the **sloppy writing** of an employee. Lazy Dog, in fact, has worked with a number of direct-mail firms to perfect this technology.

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> "Personal fonts" will give you executives out there the opportunity to "handwrite" all those letters and memos that are actually written by the secretary.

Terror in the Aisles Dept.: It's about time we took a serious look at computer security. Do you want the office snoops reading your mail? You can be sure that **they are.** There are even network software tools that allow people to watch your keystrokes as you type.

While these tools to invade our privacy continue to appear, so too do **tools to protect privacy.** If you haven't been following the scene, encryption and message verification are the hot topics in the computing community. Whatever you need to know is answered by the **single dominant firm** in the business: RSA Data Security. The developers of the patented Revest-Shamir-Adelman (RSA) encryption algorithm are actually a group of **theoretical mathematicians** using state-of-the-art algorithms to create their system.

Most major software firms have licensed the RSA technology already. It utilizes the **practical public key/private key** method of encoding and decoding messages. The sender uses the public key (a password or code that everyone can access) to encrypt the message. Only the private key (used only by the recipient) can decrypt the message. It appears to be a **foolproof** system. In fact, RSA software **offers $10,000 cash** to anyone who can crack its system.

There are probably three major developments leading to the incredible popularity of the RSA software. One was the recent **cracking of the WordPerfect security system.** It was "effortless," I was told. The second was **the discovery of a "back door"** in an encryption system (using the El Gamal encryption algorithm) about to be approved by the U.S. Government's National Institute of Standards and Technologies. It's logically believed that the National Security Agency doesn't like the idea of truly secure encryption, since it means the NSA won't be able to keep tabs on foreign spies easily. Onlookers suspect that NSA was behind the "back door" in the El Gamal–based system and accuse the NIST of "playing games." And finally, RSA's Adi Shamir is believed to have **cracked** the old but still useful Data Encryption Standard (DES) by **using math alone!** Until now, a DES-encoded message would require hours of supercomputer brute force to crack.

The company is also developing aspects of security called message verification and electronic signatures. **Internet** will be using the RSA software for its upcoming Privacy Enhanced Mail (PEM). For anyone interested in developing security for existing products or future products, RSA sells a toolkit called *BSafe* ($495) that contains binary versions of its systems. End users might also be interested in a $125 product called *MailSafe*, which will **protect your e-mail correspondence.** For more information contact RSA Data Security at 10 Twin Dolphin Dr., #B-406, Redwood City, CA 94065; 800-782-5453, 415-595-8782. This is the company to watch.

BBS of the Month Dept.: Only in America would we find a bulletin board such as West Virginia congressman Bob Wise's **Federal Whistle-blower Bulletin Board.** If you want to fink on some corrupt goings-on, then call it at 202-225-5527. When you log on, you're allowed to use any name and say anything you want confidentially. This board is operated by an investigative subcommittee in the U.S. House of Representatives, with Democrat Bob Wise as sysop. When you log on, you get the ground rules: "1. There are NO public files and NO public messages on this board. If you are looking for downloads, games, etc., you won't find them here. 2. If you have a concern about protecting your identity, please use a pseudonym." ■

Unlike most printers that merely claim to be appropriate for network applications, the QMS-PS® 1700 was conceived and built to fulfill one basic objective: To be the most efficient printer there is in a network environment. In terms of cost, as well as performance.

Proprietary software that resides within a 25 MHz RISC controller is what sets this printer apart.

It handles PostScript® documents up to six times faster than printers with the more common 68020 microprocessor. And it's the heart of an architecture that you'll find in printers from QMS® and only QMS. We call it Crown.

Crown architecture is the platform for everything that makes our printers The Network Printers.™ Consider whether its benefits would help your group work more efficiently.

The QMS-PS 1700 recognizes incoming data and selects the right printer language, without troublesome software reconfigurations.

The QMS-PS 1700 connects to Ethernet® configured as DECnet®, TCP/IP, Netware®, or EtherTalk™ or to Token Ring® configured to support Netware. And it will receive and process data over all its interfaces simultaneously. So it can be shared between multiple computers with different operating systems.

There was a time when we all worked QMS-PS *individually. We each had a computer and we each had a printer. Today, many of us work in groups.*

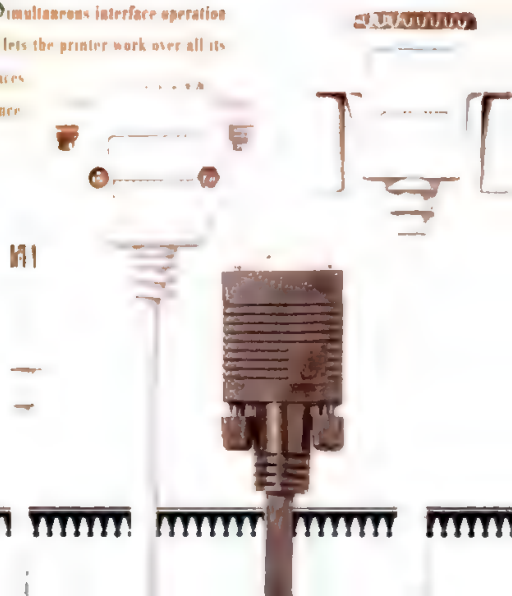
How to Sp Network Among a Host

Multi-res lets you switch between the exceptional output of 600 dpi and the speedier, everyday 300 dpi resolution

A ROM card gives the LAN administrator control over the printer's settings

The QMS-PS 1700 carries a two-year warranty. QMS national service enjoys a 97% service satisfaction rating. And all consumables and accessories are available from one dependable source – us

Simultaneous interface operation or SIO lets the printer work over all its interfaces at once



1700 We choose our computers for their ability to perform well within networks. Shouldn't the same criterion now apply to our printers?

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	QMS-PS 1700	HP IIIsi
Both 300 and 600 DPI resolution	✔	
Concurrent interfacing	✔	
Spooling	✔	
Context switching	✔	
Security system	✔	

You could compare the QMS-PS 1700 to the HP IIIsi, but there really is no comparision

Crown architecture. Proprietary hardware and software design that makes our printers The Network Printers.

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The Emulation Sensing Processor or ESP selects the appropriate printer language without time-consuming reconfigurations

The QMS-PS 1700 printed this file in 62 seconds. The HP® LaserJet® IIIsi took 188 seconds. That's almost 3 times as fast.

Its input buffers increase throughput by spooling jobs so that host applications aren't hung up waiting for files to print.

The input capacity of the QMS-PS 1700 is 1,000 sheets. Output is 500. And there's an optional duplexer for two-sided work.

What's more, if a job is interrupted for any reason, this printer has the intelligence to reprint any needed pages and then continue with the job.

Its context switching capability preserves "states", such as fonts and macros, when switching between emulations so you needn't waste time downloading them each time an emulation is selected.

Storage capacity for font caching, and font or emulation storage, can be expanded with optional internal and external SCSI hard drives.

And there's even an optional System Security Card that lets the LAN administrator control settings and avoid the chaos that can result from unauthorized end-user adjustments.

The QMS-PS 1700 is quite a bit more than a laser printer. In fact, it's exactly what most work groups need but haven't been able to find. Until now. The QMS-PS 1700 is The Network Printer.

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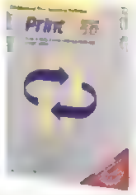

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CIRCLE 190 ON READER SERVICE CARD

Jim Seymour

The Twilight Of the DOS Gods

The growing appeal of graphical interfaces and the foresight of software developers proclaim doom for future upgrades of the major DOS applications.

Harvard Graphics 3.0 was one of the big hits of 1991. It was a critical success: It won raves from reviewers and remains the best DOS-based business-graphics program extant. And it was certainly a financial success for Software Publishing Corp., which upgraded a substantial part of its installed user-base, attracted some new users, made its customers feel good about SPC's commitment to them...and put a potful of money in the bank.

So when are we going to see *Harvard Graphics* 4.0? My guess: never.

Major DOS applications are in a kind of twilight zone these days. Overwhelmingly, vendors' development efforts now go toward building new, graphical-user- interface versions of their software hits and to cooking up new GUI applications that never existed in the character-oriented DOS world.

Thus, the resources available for upgrading DOS programs are pretty thin.

My colleague William F. Zachmann has pointed out how skewed this reaction among software developers really is. His guess concerning the actual presence of Windows in the market is that only about 5.5 percent of all PCs run Windows now. (Whether Will is right on the button or merely close isn't important. I think his guess is pretty good, given the size of the personal computer market as a whole, the total number of copies Microsoft has shipped, and the very large percentage of those copies that I believe have become shelfware.)

Why would developers bet so much of their future on an operating environment that is today running on probably less than 6 percent of the installed base of PCs?

In part, because software development is always a bet on the future, and it does look like Windows, its derivatives, and its successors will someday be the dominant business-PC operating environment.

But there's more to the story. First, many of today's DOS programs are already highly developed, mature applications. Second, people write software for active purchasers: those in the market to spend money at any given moment, not merely those who are content with what's running on their PC today. And third, new Windows programs get a lot of attention in the trade press, among users groups, and in other places where purchasing momentum is built. So it's easy to understand software firms' diversion of resources, and attention, from DOS to Windows apps.

There are countervailing forces, however. Publishers want to keep that implicit bond with their customers: the notion that once you make a commitment to a program, you can expect to see continual improvement in succeeding versions. And upgrade income is a major source of revenue for almost every software company. A large installed base can become a fantastically rich annuity for a publisher—a well that can be tapped over and over again. You and I may not think the $50 to $150 we pay for upgrades is big money, but multiply that by a few hundred thousand copies and it becomes very big money indeed.

Management at firms such as Software Publishing certainly isn't unaware of that revenue stream (the cash from *Harvard Graphics* 3.0 upgrades made a big difference in SPC's balance sheet last year), and you can bet that they won't walk away from it altogether. So we can certainly expect minor, tweaky upgrades from time to time—the 3.1s and 3.2s of the software world.

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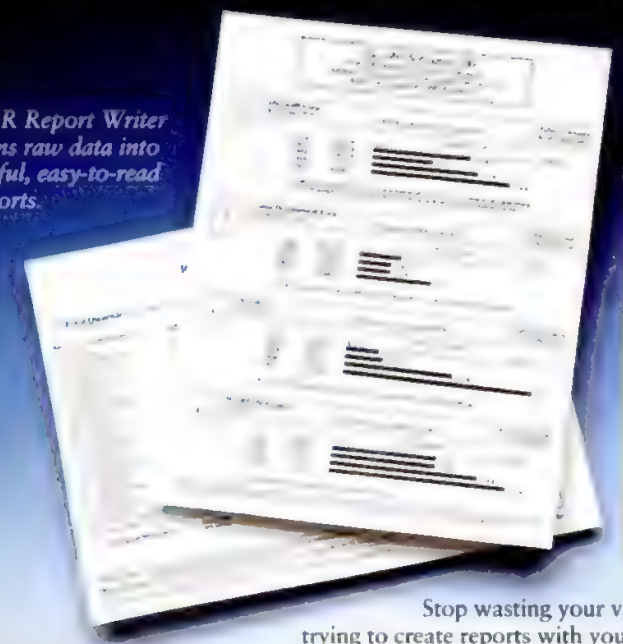

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CIRCLE 315 ON READER SERVICE CARD

Jim Seymour

I chose *Harvard Graphics* in part because of the stunning improvements in Version 3.0—a level of commitment (and development expense) few expected to see for the underlying code. That made *Harvard* 3.0 one of those essentially mature products, without very much left to fix or add. But I also use it because as a graphics program it's a good example of how a program's uses over the next few years will shape the likelihood of major new upgrades of DOS applications.

Graphics packages are among the least likely candidates for major new DOS upgrades because they're used by people who have, well, a particular interest in graphical results. Those people are leading the move toward GUIs in general and Windows in particular. So SPC's *Harvard* installed base is being divided by market forces. Almost all of the really serious graphics people have moved or soon will move to a GUI graphics program. Those whose interest is less intense are happy with Version 3.0.

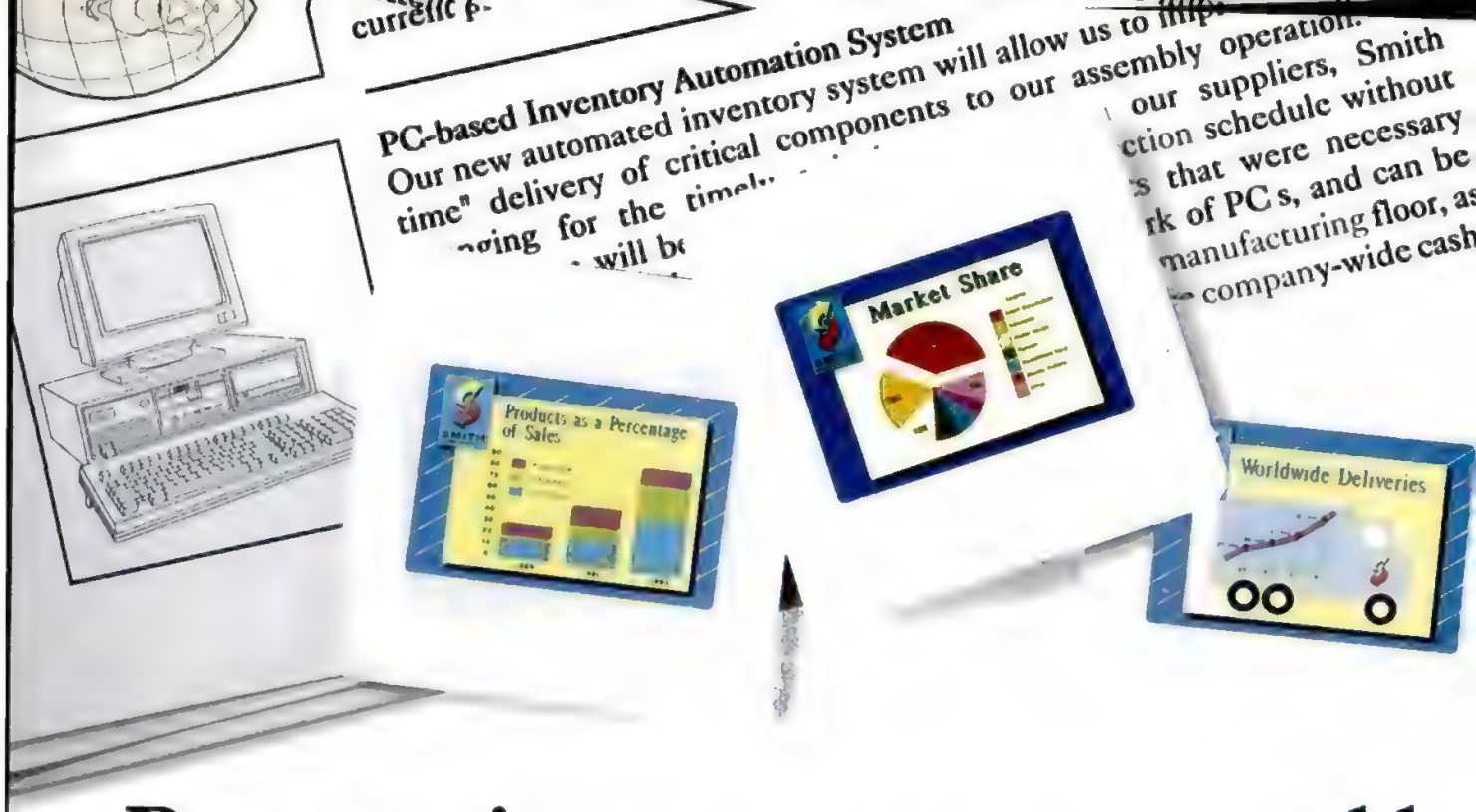
Other examples? Lotus will surely come out with more DOS-only versions of *1-2-3*, just as *WordPerfect* will probably appear in versions called 6.0, maybe 7.0, and so on. Ditto Borland. But most of those companies will in the main be mining their installed bases, milking their slowly fading cash cows for upgrade revenues.

No matter their stout claims of undying commitment to the DOS customers who made them rich, these companies are a lot more interested in producing new Windows apps and fighting for market share with other Windows developers.

I'm not among those who think Windows is about to take over the world. I still go back and forth between DOS apps and Windows apps, with a tilt towards the former. So I'm hardly claiming we'll all live happily ever after in a Window'ed future, nor am I cheering over the prospect of fewer and less-significant upgrades of many of the programs I rely on.

But this is the reality: DOS apps will draw steadily declining portions of development resources from major software publishers.

We are entering a time I've called the Twilight of the DOS Gods. They're still powerful, they're still on top, they're still in control. But less so, every day.... ■



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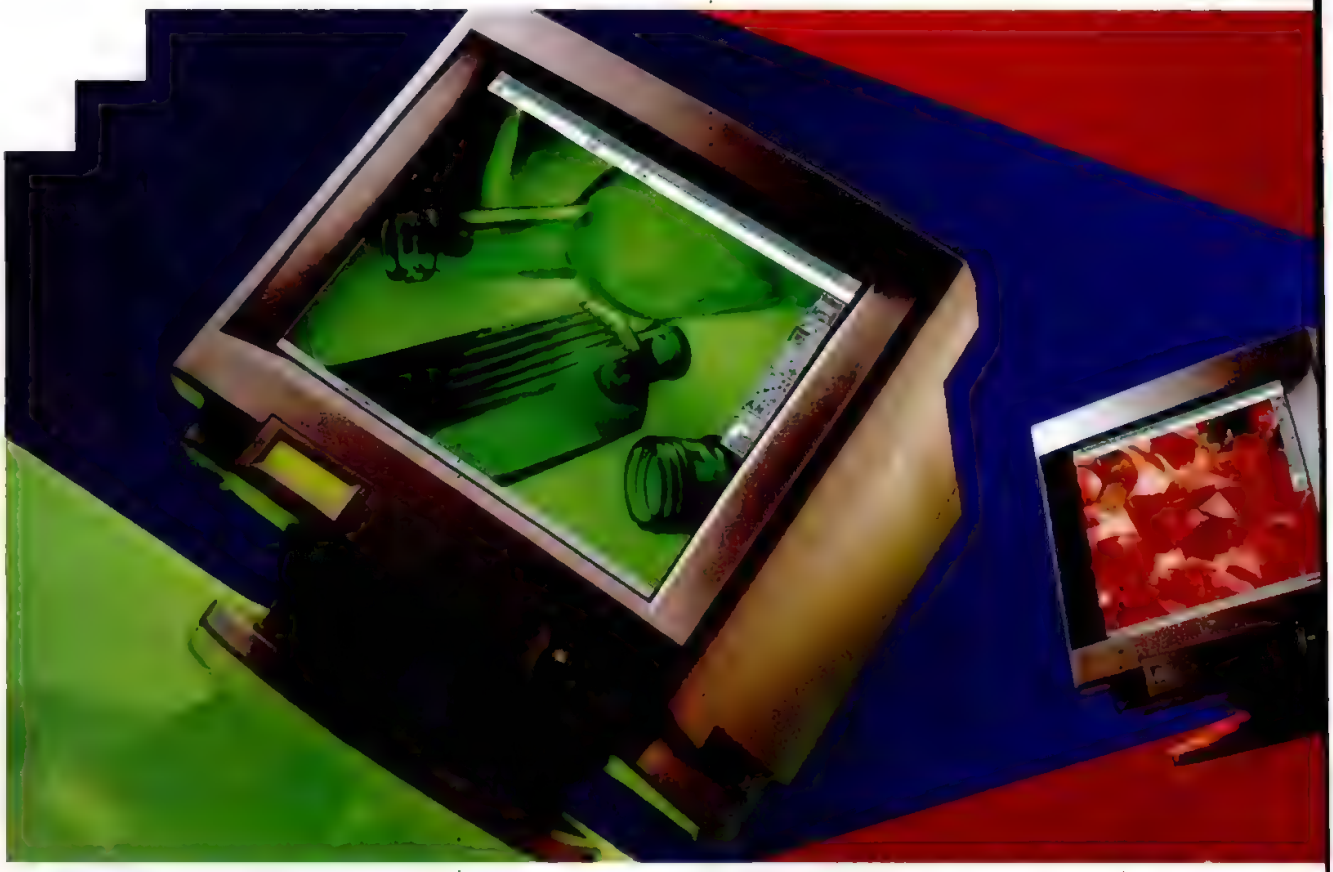

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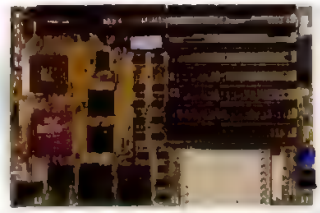

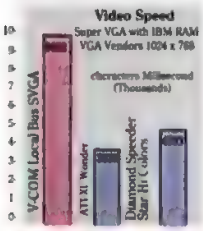

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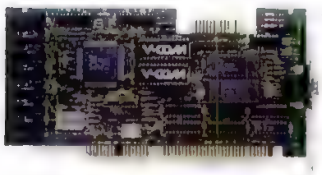

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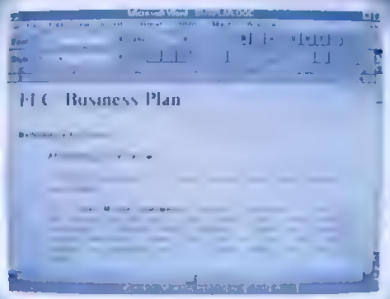

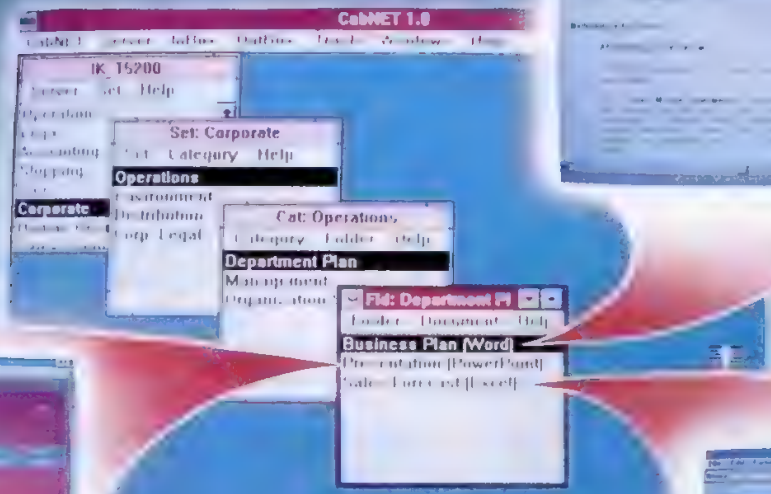

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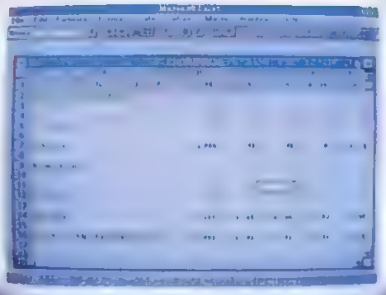

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William F. Zachmann

Virtual Reality in The Real World

Virtual reality is virtually everywhere.

"Virtual reality" is on its way to becoming the next major industry buzzword. The telltale signs are everywhere. A trickle of articles has widened to a healthy brook, which will undoubtedly become a major stream before long. Conferences about virtual reality are held regularly, and I wouldn't be surprised to see a *Virtual Reality Magazine* soon.

But, as with so many other buzzwords, it's not always clear just what "virtual reality" means. Based upon what is typically called "virtual reality," one might conclude that, whatever it is, it is not very important to folks concerned with the real world. That conclusion, however, would be wrong. Virtual reality is likely to be very important in the real world, too.

The version of virtual reality most often seen in the media is what I call the "goggles and glove" paradigm. It involves some sort of eye-goggles with mini-CRTs built in and a glove with built-in sensors to send electrical signals that correspond to the movements of the wearer. The user sees some sort of computer-generated landscape or scene through the goggles; he acts upon this world via the glove.

A simplified version of the glove is already on the market from Nintendo as a computer game accessory; Spectrum Holobyte expects to release a commercial product shortly.

In this paradigm, the computer creates a sensory "virtual reality" world for the user to explore via the goggles and glove. He then acts "in" a virtual world that appears as a very real world—wandering through scenery, slaying computer-generated dragons, playing computer-generated games, or whatever.

A more ambitious virtual reality is documented in "cyberpunk" science fiction. It's exemplified by William Gibson's splendid book *Neuromancer*. There, "computer cowboys" "jack in" to a computer-generated reality by way of direct neural implants and electrical sockets in their heads, which are wired to computer "cyberspace decks."

If all of this "plugging in" sounds just a bit too weird, then you've obviously got your feet planted firmly on the ground! It may be interesting and thought provoking, but hardly material for the normal world of business.

The "goggles and glove" model, however, is also too narrow a paradigm to define the potential of virtual reality. There are lots of other ways computers can be used to create virtual reality. Many are of much greater practical use than the "direct sensory input/bodily action output" model.

Consider something as prosaic as a computer spreadsheet. It is, in its own way, a virtual reality device. A projected profit-and-loss statement, a balance sheet, or a cash flow model are their own sort of virtual realities. They represent the potential reality of future business performance. To do "what if" modeling with *1-2-3*, *Quattro Pro*, or *Excel* is to explore possible real-world outcomes by way of the virtual reality of the spreadsheet.

Let's take a noncomputer example: a road map or a navigational chart. Each is a virtual reality that represents some territory. Its virtual reality is a practical aid to navigating through real-world territory.

Suppose we broaden the virtual reality concept to create simulated environments that model, in a far more sophisticated way, aspects of the real world. Suppose we use object-oriented programming languages to create virtual representations of objects and their behavior in the real world.

ILLUSTRATION: DAVID TURNER

These kinds of exercises open the door to radically new computer simulations that create "virtual realities" of immediate utility and practical consequence. This ability to manipulate environments within the relative safety of the computer's virtual world has serious business implications that I'll continue to explore in an upcoming column. ■

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HEWLETT PACKARD

Minnesota mom wins $25,000, WordPerfect® for Windows wins "Most Valuable Product."

▲ Judy Johnson plans to pay off her car, go on vacation, and set up a college fund for her daughter with the $25,000 prize.

So much for scientific formulas.

Judy Johnson's age, followed by her house address, ended up being the winning guess in our $25,000 contest to predict first month's orders for WordPerfect® for Windows.

In fact, Judy, who is a software programmer/analyst for Super Valu Stores, Inc., came within 40 of the actual 369,693 packages of WordPerfect for Windows ordered in its first 30 days on the market.

Although Judy at first had a hard time believing she'd actually won, when given the numbers, admitted, "Holy cow, I did all right."

But "all right" is something of an understatement. However arbitrary her method, the number Judy predicted was far higher than what most of the 7,000 contestants, software analysts, and even WordPerfect itself estimated first month's

WordPerfect is a registered trademark and Button Bar is a trademark of WordPerfect Corporation

sales of WordPerfect for Windows would be.

But perhaps the record number of sales is not as surprising as it seems. After all, WordPerfect for Windows is not only making Judy Johnson very happy, it's making a great impression on other software experts.

"Will you be thrilled with WordPerfect for Windows? The answer is a strong yes," reports *Windows Magazine*, November, 1991. And *PC/Computing*, November 1991, believes "If word processors should be all things to all people, WordPerfect 5.1 for Windows comes very close to being ideal." With this support, it's no wonder WordPerfect for Windows has been designated Winner, 1991 *PC/Computing* Most Valuable Products Award.

WordPerfect Vice President of Marketing, Clive Winn called Judy Johnson with the good news. ▼

What makes WordPerfect for Windows so impressive? Well, it's the only program that combines the feature richness and sheer word processing power of WordPerfect, with the graphical user interface of the Windows environment. Simply by clicking and dragging the mouse, you'll be able to move graphics around the page. And for those of you who don't want to let go of your keyboard, you still have the option of using function keys.

WordPerfect also gives you some unique innovations that make Windows word processing easier than ever. Our customizable Button Bar™, for instance, lets you attach the menu items or macros you use most to a button and keep them right on your screen for swift and easy access.

PC Computing MVP MOST VALUABLE PRODUCT WINNER

Imagine being able to create a table without even having to specify measurements or go into a separate menu. Just click on the on-screen ruler and drag to the size you want. And setting columns, tabs and margins is just as easy.

All these great features, together with all the ones you'll discover for yourself when you try WordPerfect for Windows, mean Judy Johnson isn't the only winner. In fact, no one accommodates different types of users like WordPerfect. We'll even license you to run WordPerfect for DOS, Windows or OS/2 (when available) on the same machine.

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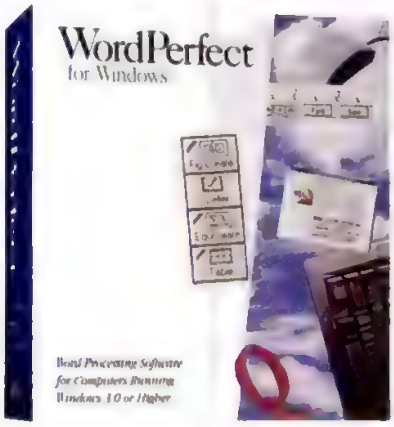

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To Inform and Convince: Ten Presentation Graphics Programs

Presentation experts maintain that direct, human-to-human communication is still the most effective way to make a point. But today's presentation graphics software can provide powerful assistance.

by Rock Miller

In today's information-driven economy, white-collar workers must learn to communicate and persuade in order to succeed. Presentation graphics packages, which began life as relatively simple communication tools (the data-charting programs of yesteryear), have evolved into sophisticated tools of persuasion. And as up-to-date spreadsheets give you awesome analytical power without recourse to corporate mainframes, the latest presentation packages give you equally awesome graphics power without recourse to corporate art departments. You can gather and shape information, freely trying out new ideas—all at your own desktop.

ILLUSTRATION: DON BAKER

By 1992, the total presentation graphics market is expected to triple in dollar volume over 1987 levels, according to Desktop Presentations, a market research firm based in Mountain View, California. This prospect seems to have presented itself as something of a marketing Klondike to graphics software vendors. Just in the year or so since we last reviewed the category ("Presentation Graphics," *PC Magazine*, May 14, 1991), a veritable gold rush of new presentation graphics packages has entered the market, all vying for your attention and your dollars.

Those with the inclination (and the hardware) to use Microsoft Windows can choose not only among tuned-up versions of Computer Associates' *CA-Cricket Presents*, Micrografx *Charisma*, and *Microsoft PowerPoint for Windows* (all reviewed in our last roundup) but also among four strong newcomers: *Aldus Persuasion*, *Claris Hollywood* (originally from IBM Desktop Software), Chartersoft Corp.'s *GraphShow*, and Lotus Development's *Freelance Graphics for Windows*. Tilcon Software's *GraphicWay* was still in beta testing at the time of our review. By the time you read this, yet another major contender—Software Publishing Corp.'s *Harvard Graphics for Windows*—will have reached the market (see First Looks, February 25, 1992). *Presentation Express II* from Business and Professional Software is scheduled to ship a DOS version by the time you read this, and a Windows version thereafter.

Things have been equally active on the DOS side of the aisle. The past year has brought us heavily revamped versions of the market leaders, Lotus Development's *Freelance Graphics for DOS* and Software Publishing Corp.'s *Harvard Graphics*, in addition to newcomers like PowerUp's *Express Presenter*.

All of these packages are designed with the needs of the business presenter in mind. They all let you create formatted word and data charts using some kind of data-entry form, annotate them using vector drawing tools, and batch them into presentations for production on laser or color PostScript printers or as 35-mm. slides. All support scalable vector fonts, so you can select type in any size, and all can import graphics in vector formats.

There's clearly a need (and a market) for professional-level packages with enhanced color and image support for the slides designed by commercial artists. In fact, illustration packages such as *Arts and Letters* or *CorelDraw* are popular for just that purpose. Business presenters need a different tool—one that helps them create attractive presentations *quickly*, without a lot of training or artistic skill.

OUR CONTRIBUTORS

Ted Stevenson is *PC Magazine*'s associate editor responsible for software reviews, and was also in charge of this graphics article.
Lori Grunin, currently the associate editor for graphics reviews at *PC Magazine*, served as PC Labs' project leader for this story.
Gayle C. Ehrenman and **Carol Levin** are staff editors of *PC Magazine*.
Barry Simon and **Luisa Simone** are contributing editors of *PC Magazine*.
Kellyn Betts, Carol Ellison, Rock Miller, Wendy Dugas Pérez, and **Tom Unger** are free-lance writers and frequent contributors to *PC Magazine*.
Paul Murphy is a partner in Singer-Murphy Associates, a New Jersey land-surveying firm. He is a sysop on PC MagNet and a frequent contributor to *PC Magazine*.

WINDOWS OF OPPORTUNITY

In pursuit of this goal, the Windows packages have a tremendous advantage. Most follow the design made familiar in *PowerPoint* and *Persuasion* on the Macintosh. Typically, these packages let you choose between a single-slide view for detail work on each image, a multislide view and title list for sorting, and (usually) an outline view for editing the text of your presentation. Ideally, all of the views are linked, so any changes you make in one appear automatically in the other. You can mix live chart objects (chart graphics that are interactively linked to the data that define them), freehand graphics, and word-wrapped or formatted text boxes on the same image, and edit them simply by double-clicking.

This concept—a presentation processor, if you will—has many compelling advantages. The capacity to focus both on complete presentations and on individual images helps you shape the overall flow of your ideas as well as the details. Global layout styles and color schemes let you bypass time-consuming design decisions while ensuring that your results are visually consistent and professional in appearance. They also let you make global changes without a lot of repetitive adjustments, while at the same time remaining flexible enough to support just about any special variations you want to make.

It all adds up to a simple, natural metaphor that you can learn quickly and remember easily, even if you haven't used it in a while. And this is critical, because if you're like most business people, you don't use graphics packages every day.

Windows' technical advantages are crucial, too—whether you're a novice or an expert. With its large extended-memory spaces, you'll have plenty of room for complex code and large graphics images. Windows' integration capabilities, from the Windows Metafile (.WMF) standard to Object Linking and Embedding (OLE) and Dynamic Data Exchange (DDE), make it easier for you to pull together information from a variety of sources. Above all, its universal imaging model means that you'll have high-quality font, color, and device support as a matter of course, without the hair-pulling limitations and qualifications that you'll find with most DOS programs. Given suitable screen and printer drivers, plus a font manager such as *Adobe Type Manager*, you'll really be able to see on-screen pretty much what you'll get on paper or film.

DOS OUTDISTANCED

The integrated Windows programs are such an improvement over the old fill-in-the-form multimode programs that it's hard for these DOS packages to compete. Nonetheless, the DOS market is still important. Not everyone can (or is willing to) make the hardware investment to run Windows, and older machines that don't run Windows well will remain with us for some time. But DOS programs tend to be smaller and easier to fit into the limited storage and memory capacities of laptops. Finally, some people prefer faster text-mode data entry to the comparatively slow WYSIWYG entry of Windows.

The latest versions of DOS programs have moved to match at least some of the advances of their Windows cousins. Though you typically must fill out a table to create a chart, then pull the results into an annotator for further refinements, the newer programs make it easier to keep everything in place as you go. Of the market leaders, *Harvard Graphics* is the most dramatically changed: Its revamped

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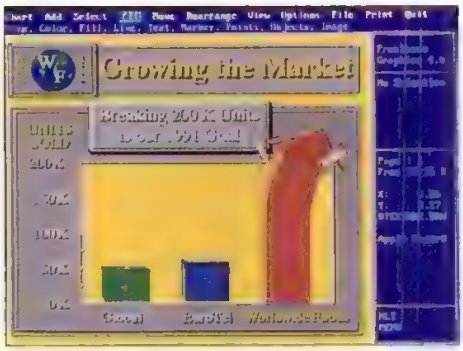
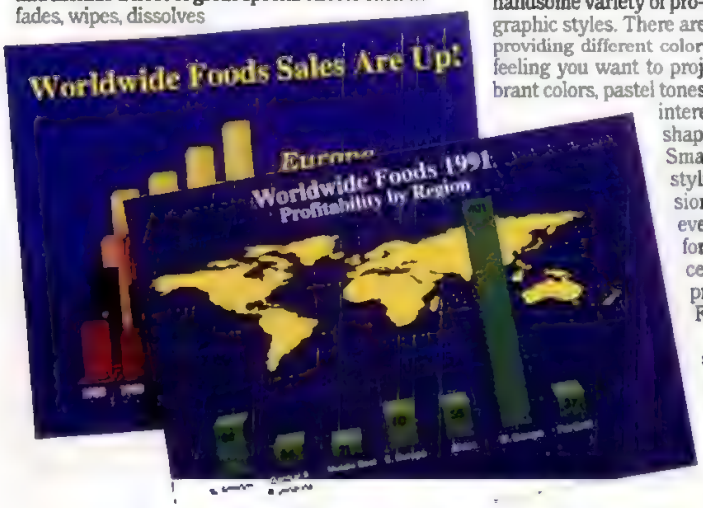
Presentation graphics packages are judged on three distinct categories: It must be fast and easy to use. It must contain sample layouts that make organizing information a breeze, and it must be a WYSIWYG environment that contains powerful graphics tools to illustrate ideas, and lets you see actual colors and fonts as you work. Sure, there's more, but these are the fundamentals. Without this framework, your presentations could go up in smoke.



Fully featured charting ease. Includes every chart type you could ever want. Linked to data files, charts are always up to date — automatically.

Freelance Graphics offers all of these fundamentals and adds a magnificent array of tools and unique "Smart Features" that represent the best way to assemble a "knock their socks off" presentation. It comes complete with 55 pre-designed chart templates, 13 ready-to-run chart types (including bar, pie, text, line, x-y scatter and more) and a gallery of over 1000 top-quality symbols and graphics for use in your presentations. You can also create your own graphics or scan in logos, graphics and designs.

If you like, you can run your presentation right on your PC with Freelance Graphics' Screen Show — and include a host of great special effects such as fades, wipes, dissolves and more. You'll get your message across with a powerful presentation.



Freelance 4.0 New Features

- *Graphical WYSIWYG Environment* — Freelance Graphics now offers users a unique graphical WYSIWYG environment. Which means that you can work with actual colors and fonts right on your screen so you always know what your output will look like before you print.
- *Portfolio* — Portfolio is the built-in presentation manager for planning, producing, and printing dynamic graphics.
- *Presentation Design Backgrounds* — You can give all your slides and overheads a consistent, professional look by automatically assigning one of 90 included presentation backgrounds with a few simple steps.
- *Outliner* — Make stacks of Freelance Graphics text charts in minutes using the companion Outliner with its simple work-processing interface.
- *Autocharting* — You can use a single command to update and print hundreds of charts with new data from your spreadsheets.
- *Chart Gallery* — Get a jump start on charting by choosing from a gallery of 55 pre-designed chart templates. Each one has sample data that you can replace with your own.
- *Charting Tools* — Simply type in your data directly or bring it in from your spreadsheets or other applications. Choose from 13 ready-to-go chart types.
- *Links to 1-2-3* — Freelance Graphics offers the best direct links to *all* versions of 1-2-3 and Symphony. A direct link lets you actually view your spreadsheet and select ranges for charting from within Freelance Graphics.

NEW! FOR WINDOWS

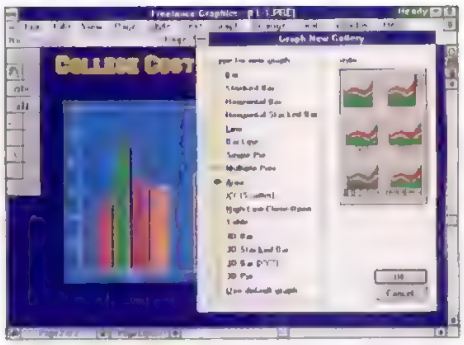
The Premier Presentation Product On The Windows Platform.

For Windows users, the power and beauty of Freelance Graphics explodes with an incredible assortment of graphics tools based on the DOS version, but taken to a new level of visual excitement and functionality.

Unlike Freelance Graphics for DOS, Freelance Graphics for Windows contains an innovative set of features known as SmartMasters. These "presentation templates" allow you to choose from dozens of professionally designed formats for title pages, bulleted items, graphs, charts and text placement. Using these advanced templates is easy; just pick the one you like the best for your presentation's page layout, provide Freelance with the content and the rest is virtually done for you!

SmartMasters are grouped in sets that contain a handsome variety of pro-quality formats with similar graphic styles. There are 49 SmartMaster sets, each providing different colors and styles to capture any feeling you want to project. Choose from bright, vibrant colors, pastel tones, deep colors and a variety of interesting background patterns, shapes and graded tones. The SmartMaster concept delivers stylistically consistent, professional quality presentations every time — with minimal effort. You spend your time concentrating on your presentation's message; Freelance gives it impact.

And since SmartMaster sets contain the same formats, you can actually switch sets, to change the entire look of your presentation automatically, without tedious clean-up. You can use SmartMaster sets as is, or customize them any way you want.



Advanced charting. Choose from a multitude of different styles and types such as bar, stacked bar, horizontal bar, horizontal stacked bar, line, bar-line, single pie and more.

Those Irrepressible SmartIcons!

Freelance Graphics for Windows employs SmartIcons, similar to those found in Lotus 1-2-3 for Windows and Ami Pro 2.0. They provide the same single-click access to common functions and commands. You can cut, copy, delete, save a file, make text bold, italic, cascade windows, tile windows, undo the last operation, print, rotate and more just by clicking on them. Customize your palette of SmartIcons by arranging them to suit the way you work. They make working with Freelance Graphics for Windows simple, fast and fun.

Once you've established a clean, consistent look for your backgrounds and charts, you can quickly add professionally designed symbols, designs and logos from Freelance Graphics' library. There are hundreds of images to slam home your message! You'll find buildings, light bulbs, telephones, computers, countries of the world, flags, money, sports, hands, industrial logos, grids, people, office objects, scientific images, text boxes, word balloons, time images, transportation, U.S. government images, weather images and hundreds more — all available with just a click.

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drawing module is flexible and has a number of color and drawing options. *Harvard*'s main competitor, *Freelance Graphics for DOS*, looks less impressive, but the latest version of the program adds live chart objects and a one-way outliner to the old design.

If you are inclined to choose a DOS package, you should also be prepared to contend with some limitations. Don't count on being able to use a high-resolution graphics adapter. And if your plans call for a film recorder, you'll probably have to select it from a very narrow range of choices (except with *Presentation Express II*). Without Windows' color management facilities, color and palette issues can be a problem as well. Most of all, expect inconveniences with fonts. Though Bitstream's Speedo technology opens up to DOS programs the same type of high-quality scalable font standard that Windows users enjoy, only one of the currently available DOS packages *(Harvard Graphics)* fully supports it for both screen and printer. Most use proprietary fonts that are not as good-looking as Speedo fonts or as rich in selection.

For these reasons, unless your needs are very simple, graphics is one job that's worth doing under Windows, even if that means upgrading your system to do it.

AN EYE TO BASICS

Today's spreadsheets produce much classier charts than their ancestors did, but there's still plenty of value to be gained from a dedicated graphics package. Depending on the package, you may or may not find more types of charts (*Persuasion*, for instance, does organization charts automatically). But you'll find more options for customizing charts and for adding notes and labels. The package should produce visually superior results.

Technical users—and this category

EDITORS' CHOICE

■ ***Freelance Graphics for Windows***

The recent flurry of competition in the presentation graphics software market has had the usual effect: It raised standards. Indeed, we saw a significantly stronger field of products in this roundup than we did about a year ago. But the trend is not simply toward *better;* most of the development effort expended over the last year has been devoted to Microsoft Windows–based packages. While the two biggest players in the DOS market—Software Publishing Corp.'s *Harvard Graphics* and Lotus Development Corp.'s *Freelance Graphics*—have faithfully and significantly upgraded their venerable DOS products, the future clearly lies with their Windows-based offspring.

Our Editors' Choice is one of those offspring: Lotus Development Corp.'s *Freelance Graphics for Windows*, Release 1.0. *(Harvard Graphics for Windows* is on the way, but wasn't shipped in time for this review.) *Freelance/Win* outclassed the competition in just about every evaluation category. In a field of products that by and large addressed ease-of-learning and ease-of-use issues successfully, *Freelance/Win* stands head and shoulders above the rest. This package is so user-oriented you almost don't need to *learn* it. Nonetheless, *Freelance/Win* produces highly professional results, largely due to the careful design of its SmartMaster sets around which presentations are built. Presentation management or structure is another of *Freelance/Win*'s particular strengths. The user can move freely among three dynamically linked working views (full-page, multislide, and outliner). Changes are easy to make and can be implemented at any time, in any order. This makes for an exceptionally smooth work flow.

Honorable mentions go to two packages: *Harvard Graphics 3.0* and *Aldus Persuasion*. For users who are still bound to DOS for whatever reasons, *Harvard Graphics* has emerged as the one clear choice. The latest version contains a first-rate drawing module with myriad drawing tools and support for 24-bit color. It also provides a selection of scalable fonts, and *Harvard*'s screen-show capabilities are still the best available, bar none.

Aldus Persuasion is, of course, a Windows package, and an excellent one. It just isn't quite up to the measure of *Freelance Graphics for Windows*, except in two areas. First, it's true, the collapsible outliner and separate title sorter make it a better presentation manager when the big picture gets really big (more than 20 pages, for example). Second, we found *Persuasion*'s text-charting performance to be the best of the bunch. The caveat here is that few users may care about refinements like adjustable kerning and leading, sub- and superscripts, multicolumn charts, and the like—all details that set *Persuasion* apart from the pack. For those who do, *Persuasion* is a versatile and well-rounded performer with that extra something that might just make all the difference.

Microsoft PowerPoint for Windows, last year's Editors' Choice, has been outstripped by more full-featured competitors. Its superb presentation management doesn't make up for its minimal charting and drawing abilities.

Charisma still offers the best charting and drawing, plus great file import/export. *PageMaker* users should note that *Charisma*'s .GRF and .DRW files can be placed directly, making *Charisma* a must-have.

Freelance Graphics for DOS, once the equal of *Harvard Graphics*, has now become an also-ran, falling significantly behind in features and functions.

Claris Hollywood and *GraphShow* are promising newcomers, but both are in need of a trip back to the drawing board. Despite an excellent storyboarding option, the DOS-based *Express Presenter* suffers from an exceedingly awkward interface and limited file-import options. And finally, *CA-Cricket Presents* beats the competition with price: It's about $200 cheaper than most of the products in this review. Unfortunately, what you gain in savings you lose elsewhere—in ease of use and in charting options, which are minimal.

From the start, VGA was missing one important thing: Video.

VideoVGA brings high quality, recordable video into the Video Graphics Adapter picture. It's true that all VGA boards allow PC users to display graphic images on their monitors. Great, but then what? The printed hard copies or slides—even at their sharpest—just sat there. All too often, so did the audience. VideoVGA takes you to the next step, which can also be a giant leap for your presentations and training.

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If you can shoot it on video, or can create it with your PC, then VideoVGA lets you record it to videotape or videodisc. You can even overlay graphics on live or recorded video. And because of VideoVGA's advanced encoding, the video output is a high-quality NTSC signal, not a fuzzy substitute. Your audience can see the difference, so don't blur a good message with poor output quality.

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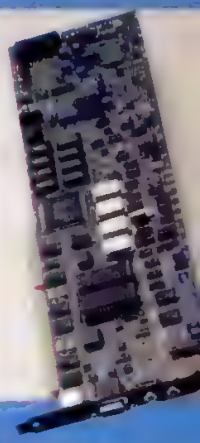

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SOUND AND FURY: Presentations in the Multimedia Age

by Luisa Simone

What do you get when you mate WYSIWYG graphics with Microsoft Multimedia Extensions for Windows? A new paradigm for desktop presentations, and one that allows you to preview the look, sound, and motion of your screen presentations even as you create them.

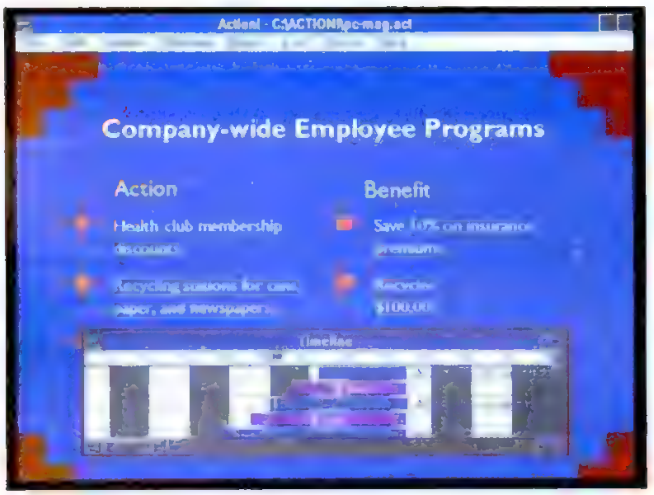
DOS-based screen show programs, such as IBM Corp.'s *Storyboard Live!*, Brightbill-Roberts & Co.'s *Show Partner FX*, and V_Graph's *VirtualVideo Producer* (reviewed in Volume 10, Issue 9), traditionally rely on a script language to coordinate the various elements of a desktop presentation. Working with a script means that you string together a list of commands to load image and sound files, create transition effects, include animated sprites, and execute GOTO routines. But viewing the results is a totally separate operation.

In contrast, the new Microsoft Windows–based programs, such as MacroMind/Paracomp's *Action!* and Gold Disk's *Animation Works Interactive*, allow you to assign motion and sound effects in WYSIWYG mode and to run interactively portions of the presentation at any point in the creative process. In addition, Microsoft's Multimedia Extensions gives both programs access to CD-ROM drives, sound boards, and digitized audio or video. Those are the similarities; in practice, *Action!* and *Animation Works Interactive* differ significantly in their tool sets, multimedia capabilities, and approaches to desktop presentations.

ACTION!

The familiar structure of screen-show programs is the foundation on which *Action!* is built, but with two major differences. Instead of switching among several different modules as you work, you do all of your work directly in the presentation window. And instead of static slides or screens, you work with active *scenes*. As with traditional screen show programs, you assign a duration (in minutes, seconds, and decimal seconds) and a transition effect (wipe) to each scene in your presentation.

However, you can also apply effects to the individual text and picture elements within each scene. Each object's sojourn on-screen is divided into three phases: Enter, Hold, and Exit. For each phase you determine the duration, the transition, and the motion to be applied. For example, you can have a title enter the scene quickly from the left, shimmer while it remains in the Hold position, and then disappear slowly with a vertical wipe.



***Action!* templates add movement to standard business presentations. The text in the right column of this bullet chart is actually in the middle of a transition effect (a wipe from left to right) that has been assigned to the Enter phase. The Timeline at the bottom of the screen allows you to play back a presentation and also gives you an overview of the relationships between elements.**

Orchestrating the actions for individual objects is simple: Templates that include motion effects allow you to create most business presentations merely by typing in your text. Even when you generate a presentation from scratch, you actually arrange all of the elements in their Hold position, and then apply the animation attributes via tool and dialog box options. Finally, *Action!* provides several different views of your presentation—including a Timeline, a Content List, and a thumbnail Scene Sorter—all of which can be used to edit the screen show. However, as the number of objects increases, so does the difficulty of coordinating their movement.

Action! allows you to control your presentation with simple commands that include inserting pauses, creating loops, and generating GOTO command buttons. However, in order to play back your presentation you'll need a complete copy of this $495 program installed, because *Action!* does not include a runtime playback utility.

When the time comes to import elements from other sources—the key to successful and memorable multimedia presentations—you'll have to live with some limitations. For example, although *Action!* can play back sounds across multiple scenes, and can even associate sounds with individual objects, it will only access .WAV files and CD-audio (MIDI files are not supported). Likewise, *Action!* only imports foreground pictures in .DIB, .BMP, or .WMF format (you can use the bundled Convert program to translate files from standard formats such as .PCX, EPS, .GIF, and .TIF). In addition, *Action!* handles only one disk-based, video format, which is (not surprisingly) MacroMind's *Director* movies that have been converted from their native Macintosh format for PC playback.

ANIMATION WORKS INTERACTIVE

Gold Disk's *Animation Works Interactive* departs from traditional screen-show programs by using a movie metaphor to help you create your presentations. The $495 program consists of three modules (four if you count the runtime playback utility). However, the Cel Editor and Background Editor are basically paint programs that allow you to create the objects and scenery

that will be part of your movie. (A *cel* is any self-contained moving object in an animation sequence.)

The heart and soul of this program is the Movie Editor module, where you create the multiple frames of your presentation and combine the cel and background elements. To add motion to a cel you use one of six path tools to draw straight, curved, or freehand lines. *Animation Works Interactive* then automatically paints the element in each frame of the movie at a slightly different location along the path. When you play back the movie, objects appear to move.

Animation Works makes complex motion paths easy to handle. For example, the program includes path tools to simulate the effects of gravity, or to easily add movement to text elements. Best of all, the program retains the path in memory, so editing motion is as simple as grabbing a node along the path and dragging it to a new location.

By importing standard file formats, like .BMP, .TIF, .GIF, and .PCX, *Animation Works* makes it possible to incorporate bitmapped images from other applications. (*Animation Works* does not currently support vector images.) If you have been dabbling with AutoDesk's *Animator* you'll be happy to hear that you can bring your .CEL and .FLI files directly into *Animation Works*.

The real power of *Animation Works* is that it allows you to add sound (from .WAV, MIDI, or CD-ROM sources), video (via any Media Control Interface (MCI) compatible hardware), and two different kinds of branching routines. As events, all of these activities will take place as part of the normal flow of an animation. So, for example, you can insert a loop event in frame 20 that will start playing the animation from the first frame. However, if you choose to associate these same activities with an object, you can make your presentations interactive by designating a keystroke or mouse click to trigger a specified range of frames, a video segment, or a sound. Clicking on the animation of a bird in flight, for example, could be the cue to play the audio clip of a hawk's cry, or a robin's chirp.

A BOUQUET OF CAVEATS

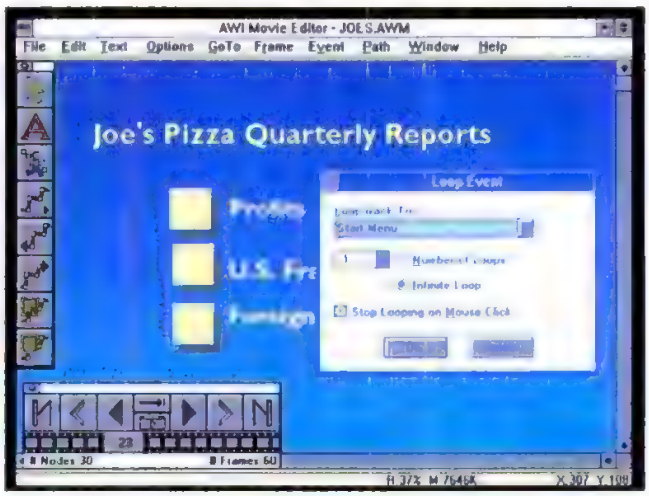
If *Action!* and *Animation Works Interactive* are indicative of multimedia under Windows, there are several important caveats to consider. For one thing, you must still worry about incompatible graphics resolutions and conflicting palettes because both of these programs require you to set the screen size and live within the confines of 256 colors.

Further, you'll find that no one has developed standard interface conventions to control external devices such as video disk players or video overlay boards. Although you can control MCI-compatible devices from within *Animation Works*, for example, you must do so by typing the commands into a dialog box. *Animation Works* merely passes the commands through to the hardware.

Most important, the performance of Windows—and in turn both *Animation Works Interactive* and *Action!*—degrades progressively as you increase the number of animated objects and multimedia elements. On our tests, for example, *Action!* literally paused moving objects in order to load sounds from the hard drive or CD player.

Microsoft has announced that the upcoming version of Windows 3.1 will include multimedia capabilities and will ship with a host of drivers for video and audio hardware. So it's no surprise to learn that many standard presentation graphics programs, such as *Aldus Persuasion*, *Harvard Graphics*, and *Microsoft PowerPoint for Windows*, have all announced plans to upgrade their screen-show utilities to support selected multimedia functions.

However there is every reason to believe that those functions will be limited to voice annotations and video playback. True animation functions and sophisticated branching subroutines will probably remain in the realm of multimedia authoring systems and desktop presenters such as *Action!* and *Animation Works Interactive*. ■



You can easily create repeating menus in *Animation Works* by inserting a loop event that returns the viewer to the start of the movie. You can indicate specific points in your animation either by referring to frame numbers or named markers.

Animation Works Interactive
Gold Disk Inc., P.O. Box 789, Streetsville, Mississauga, Ontario, Canada L5M 2C2; 416-602-4000.
List Price: $495.
Requires: 2MB RAM, 5MB hard disk space, VGA graphics adapter, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later.
Optional Equipment: Microsoft Multimedia Extensions 1.0 or later, CD-ROM drive with MSCDEX 2.2 or later, MPC-compatible audio board, MCI-compatible video overlay board.
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Action!
MacroMind/Paracomp, 600 Townsend St., #300 West, San Francisco, CA 94103; 415-442-0200.
List Price: $495. **Requires:** 4MB RAM, 256-color VGA adapter, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later.
Optional Equipment: Microsoft Windows with Multimedia Extensions 1.0 or later, CD-ROM drive, audio card.
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includes many marketing and financial specialists, as well as scientists and engineers—have some special charting needs. Current business-oriented graphics packages support these needs poorly, but prospects for the near future are brightening. *Stanford Graphics* and *Delta Graph*, two powerful new Windows-based presentation packages with a strong technical slant, are slated to hit the market by late spring of 1992. (See the sidebar "Stanford Graphics: Technical Presentations Arrive in the 20th Century.")

In evaluating charting modules, nontechnical users should keep in mind the following important, but often neglected, factors. First, be wary of poor data handling because it can waste an enormous amount of your time. Presentation graphics programs should be flexible enough to accept data the way the real world stores it (usually in spreadsheet, database, or other computer files that you can import without having to first make adjustments); in practice, few are this flexible. The very

STANFORD GRAPHICS: Technical Presentations Arrive in the 20th Century

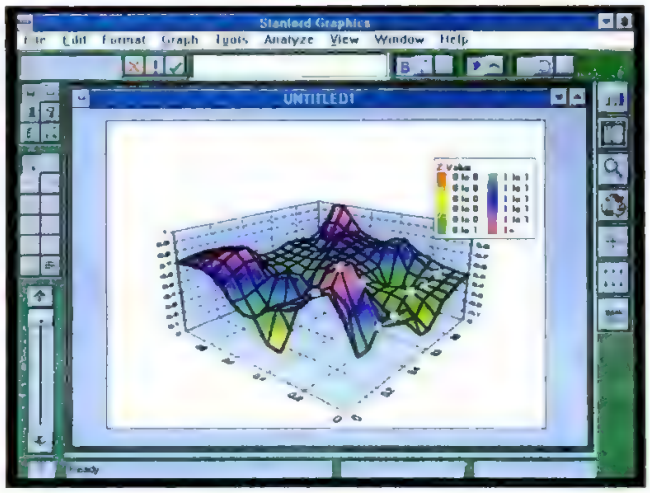
by Barry Simon

Typical business presentation graphics packages can't handle lots of data points, and most offer few chart types beyond variations on the ubiquitous bar, line, and pie. And the third (spatial) dimension is generally used as a visual effect rather than to display multidimensional data. The handful of packages that handle the kinds of heavy-duty charting needs that business-oriented packages can't handle are called technical-graphing programs ("Picturing Your Numbers, 12 Technical Graphics Packages," March 26, 1991).

Until recently, if you needed such a package, you were forced to cope with an interface that would only be attractive to those accustomed to batch mode on a 1970's mainframe. While technical-graphing programs have improved in the past two years, they still lack the ease-of-use of the best business presentation packages. Also, they still focus on individual charts rather than entire presentations, and still use proprietary graphical interfaces and printer drivers with limited fonts.

We've looked at a late beta of a new program called *Stanford Graphics*, which will change this perception. It's from 3-D Visions, the makers of *Graftool*, one of the Editors' Choices in our last scientific graphing roundup. *Stanford* is a breakthrough product that combines technical charting, data analysis, and presentation tools. Basically, it's fabulous.

On the presentation side, the program organizes graphs into collections of slides with a slide sorter, speaker's notes, and handouts. You can compose slide text via an outliner, enter bulleted lists, use any Microsoft Windows font, and if you need them, insert Greek and mathematical symbols with ease.



***Stanford Graphics* supports a multitude of graph types, including color-mapped wireform surfaces.**

Stanford Graphics is able to import a fistful of clip-art types: CGM, .DRW, .PLT, .TIF, .PCX, .GIF, .BMP, .PIC, EPS, .CHT, and DXF. There are nine vector drawing tools including wedges and Bézier curves.

Judged on these grounds alone, *Stanford Graphics* would be competitive in the presentation graphics market. What makes the program really stand out, though, is its impressive array of chart types and tools for examining and analyzing data.

Stanford lets you pick from more than 40 different basic graph types (with 160 total variations!), displayed in a visual chart gallery. Among the available choices are Gantt, bubble, ribbon, true 3-D columns, contour, polar, and trajectory charts.

Noteworthy is its array of statistical chart types, including histograms, Box-Whisker, scatter, and Pareto. These are true statistical chart types in that they analyze data. For example, many feature tables say any program that has column charts does histograms because if you count up and make a frequency table, the column chart you form will be a histogram. *Stanford Graphics* takes the raw data and generates the histogram from scratch. While *Stanford* doesn't have the depth of statistical procedures of the standalone statistics powerhouses, users who might otherwise purchase a statistics program for the few basic graph types it offers may find *Stanford* a better choice.

Data analysis tools include seven types of curve/surface fitting plus fast Fourier transform and Box-Whisker statistics. After fitting the data, you can call up a graphical What-If dialog box and change parameters by manipulating *sliders*, which resemble, and are called, the Graphic Equalizer. *Stanford*'s intelligent data cursor (which displays the numeric data associated with any point it touches on a graph) and magnification up to 300 percent help you focus on the data easily.

The program has a lovely interface that utilizes both standard and nonstandard elements. In the central part of the screen is the slide-making area where you can draw and manipulate graphs and objects. Double-clicking the left mouse button brings up dialog boxes for changing an object. Double-clicking on an axis, for example, lets you change scaling (among linear, loga-

least you should expect is importation of ASCII and .WK1 files; the best packages (such as *Freelance Graphics* for DOS and Windows) let you link charts directly to files on disk so that they update themselves automatically when the data changes.

The second factor to consider is the intelligence and flexibility with which charts are formatted. Can you resize and interactively reposition headings, notes, labels, legends, and other chart elements or are you stuck with a limited number of fixed choices? Can you rotate, stagger, or word-wrap labels so they don't collide or overlap? Can you easily customize bar spacings, series colors, and other design elements? How much control do you have over bullets, indents, and text spacing within word charts? These may sound like picayune considerations, but after you've lived with a package's quirks for a while, they loom large.

rithmic and probabilistic), tick marks, labels, or numeric format. Right-hand click-and-drag moves an object.

Button mania is my nickname for *Stanford*'s nonstandard interface elements. The central screen area is surrounded by no fewer than eight groups of dedicated buttons and other gizmos. Along the left-hand side, for example, is a set of iconic buttons that switch among the several presentation views (individual slides, slide sorter, outliner, and so on). Below that is a palette of drawing tools, and at the bottom of the left side is a slider for choosing among multiple slides. On the right-hand side of the screen are six icons that call up the main analysis tools, and at the top are sets of editing buttons that handle delete, undo, and redraw functions, reset text attributes, change colors, and control visual effects like shadowing or embossing of objects. All in all, it eliminates the need for lots of menu access, making *Stanford* a remarkably simple package to use.

For those whose presentations are primarily text based, 3-D Vision's *Stanford Graphics* is a viable choice, but probably not the best one. As the need for complex or nonstandard graph types begins to enter the picture, *Stanford* becomes a much more serious option to consider. For anyone who needs to integrate presentation-quality graphing with sophisticated data analysis, *Stanford Graphics* looks like an essential tool. ■

Stanford Graphics
3-D Visions, 2780 Skypark Dr., Torrance, CA 90505; 800-729-4723, 310-325-1339.
List Price: $495. **Requires:** 2MB RAM, Microsoft Windows 3.x. Mouse and math coprocessor recommended.
CIRCLE 468 ON READER SERVICE CARD

GRAPHIC AGILITY

Most presentation packages offer a good basic set of drawing and annotation tools. The best packages offer full point and Bézier-curve editing, and can use gradient fills on objects as well as in slide backgrounds. The ability to place word-wrapped text labels is another important feature; it's a big advantage over the line-by-line placement procedures typical of older packages. If you do a lot of drawing, the real proof is in the interface, which tends to vary in subtle but important degrees of usability between packages. And if you don't, make sure your package comes with a generous selection of well-designed clip art, or that you can buy it elsewhere (see "Clip Art," May 14, 1991).

Often, the image you want won't come from the clip-art library. For this reason, don't ignore file import and export capabilities. The best third-party art comes in editable EPS format, but few business packages support it (*Charisma*, *Persuasion*, and *PowerPoint* are three that do). Barring that, the other choices are .WMF, for Windows users, or CGM, whose inherent problems make it the last choice among vector formats. Most packages also let you place bitmap images in .PCX or TIFF formats.

The output stage is still the most problematic step of the presentation process—especially with color output. Though both Windows and DOS packages now come with special drivers for slide services and film recorders, you still have to watch out for problems that can occur with color palettes, image aspect ratios, and fonts. The way out of this dilemma is shown by *Freelance Graphics for Windows*, whose Autographix and MagiCorp drivers use PostScript as the image file format, as do those of a growing number of independent slide bureaus. This makes an enormous amount of sense: PostScript is device- and resolution-independent, supports a rich color model, and accepts downloaded PostScript fonts from *Adobe Type Manager* with ease. Moreover, desktop color PostScript printers are useful for producing in-house transparencies as well.

One neglected output method that is proving more and more popular today is the PC-based screen show. Screen shows deliver "the real thing" in living color, rather than a second-hand rendition of it. They have the further advantage of being cheaper and more flexible than slides for small to medium-size audiences. The ubiquity of VGA- and Super VGA-capable portables makes it easy to take your presentations out on the road with you (hooking your laptop up to a color CRT display when you get to your destination).

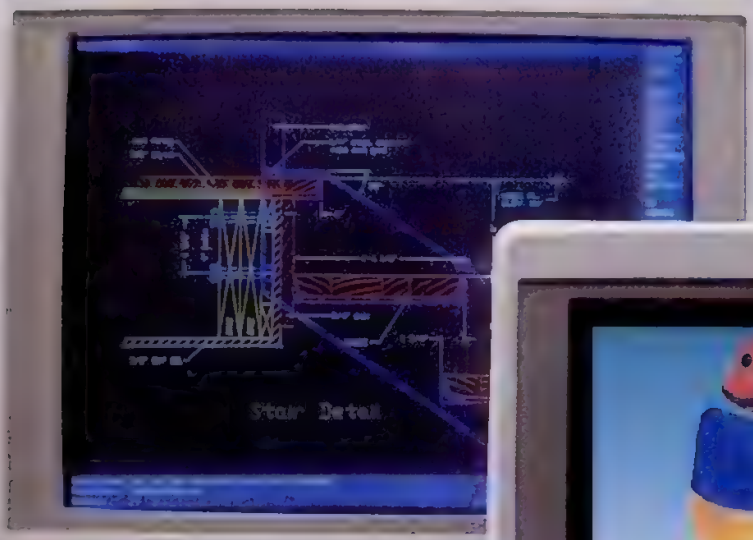
Screenshow capabilities vary tremendously between packages. A weakness of almost all the Windows packages is that they require a full operating version of Windows in order to run a screen show. Two exceptions are *Freelance Graphics for Windows*, which writes screen files that can be viewed using a standalone DOS-based utility, and *Claris Hollywood*, which includes a standalone, runtime utility. Another will be the upcoming version of *Persuasion* (Version 2.1), which should be out by the time you read this. The best of the lot, *Harvard Graphics*, lets you create hyperlinks between slides for nonlinear presentations and even supports some simple animation.

The next step down this road is multimedia—using the computer to add the dimensions of sound and animation. While the possibilities are intriguing (see the sidebar "Sound and Fury: Presentations in the Multimedia Age"), such sound and light shows are likely to prove the exception rather than the rule in the business arena: Most business presenters simply don't have the time to spend making one of these look good.

For most of us, our presentation graphics packages will probably never be as fundamental to our working lives as our word processors or spreadsheets. Therefore, it may seem odd and inequitable to have to pay the same price for the former as for the latter. Fortunately, the industry is sensitive to this issue; you should be able to find an attractive package deal

The Big Screen

ViewSonic 7 Rated #1 by InfoWorld!



20-Inch

ViewSonic 7

17-Inch

These two new **1280 x 1024** ultra high resolution monitors will soon be in offices all over the world. That's because they're so *powerful!*

Consider this: Our 17" and 20" non-interlaced microprocessor-enhanced monitors will automatically adjust the image the way you want. There are 16 preset modes which can be programmed by the end-user. With built-in memory, these monitors do what you want...and they don't forget. Plus the crystal clarity and sharp focus on the non-glare, anti-static screen are simply unbeatable. NO distortion and low radiation. The ViewSonic 7 even has a flat/square screen.

The ViewSonic 7 (17") and ViewSonic 8 (20") feature a new level of high performance for desktop publishing, CAD/CAM and other graphics-intensive applications. They are designed for PCs, Mac II and Sun systems.

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September 2, 1991

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SUITABILITY TO TASK

A presentation graphics package may appear to be a highly specialized, one-task tool, yet the one task that it's designed for is multifaceted. We identified seven task categories to evaluate the versatility of the packages in this roundup.

Many presentation graphics software users don't use their presentation products very often, and certainly not frequently enough to maintain a high skill level. **Quick/infrequent presentations** evaluates a package's usefulness to a first-time or infrequent user. To receive a good score, it should be easy to learn; it should let you resume use easily after a hiatus and create attractive presentations quickly.

Presentation management rates the balance between the details (individual pages or slides) and the large picture (the overall flow of ideas). A well-designed presentation product should allow users to move freely among a full screen, a single-page view, and a thumbnail view to show all the slides in order; a text-only (or outliner) view seems to be the most productive approach for facilitating strong presentation structure. The abilities to create handouts and speaker's notes quickly and easily and to switch among multiple output devices are also important considerations.

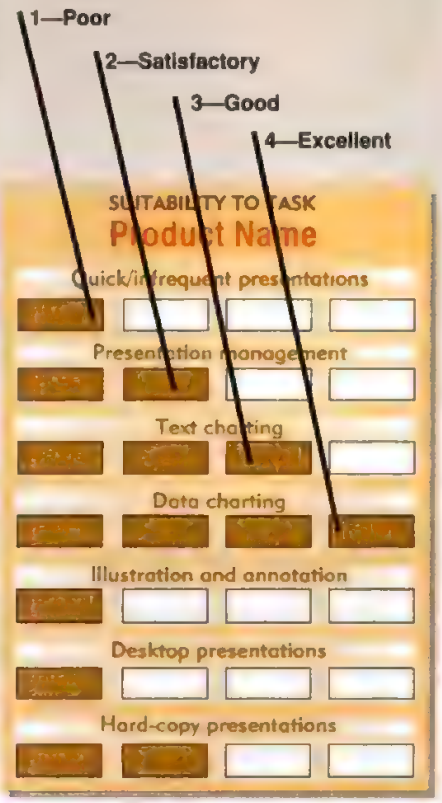
Text charting forms the core of most business-oriented presentations because it allows a presenter to underscore the essence of a verbal message visually. The speed, ease, and flexibility with which the text can be arranged and formatted are fundamental measures of the prowess of a presentation package.

Two or three years ago people considered presentations and data charts synonymous. While that is no longer the case, **data charting** still makes up an important component of most presentations. The breadth and types of automatic charts, the flexibility of data import, linking, and manipulation, and the potential for customization are the fundamental issues to consider when evaluating a package's data-charting abilities.

Notes, comments, labels, arrows, pointers, and illustrations can add impact to even the handsomest charts. For this reason, presentation packages come equipped with **illustration and annotation** tools (and clip-art libraries) to simplify the task of enhancing their basic output. Flexibility of file importing, ease of color handling, and usability of the drawing tool set are of primary importance.

An effective method of displaying the fruits of a presentation designer's labor is the screen show, where images are displayed on the PC's screen. **Desktop presentations** evaluates the degree of user control over the duration and sequence of the display (hyperlinks are a big plus) and the selection of transitional effects between images. Runtime screen shows, which don't require you to launch the entire application, add value.

Hard-copy presentations evaluates the ease and affordability of 35-mm. photographic slide output and other hard-copy options. Slide output is certainly the best way to exploit the color capabilities of today's presentation packages, but other hard-copy options include laser printing—either full pages or reduced images grouped on a page as handouts or speakers' notes. Not all packages deal equally well with the demands of interfacing with a variety of output devices; the ability to transparently switch among them with little or no page reformatting is a huge time-saver and is almost as important as the attractiveness of the output.



without much difficulty (both Microsoft and Lotus have bundled their graphics offerings in aggressively priced two-for and three-for offers). Considering the power, convenience, and flexibility of the latest products, it shouldn't be too hard to justify the investment in a presentation graphics package. If you plan to follow the graphical path to persuasiveness and success, you'll need one of these packages.

ALDUS CORP.

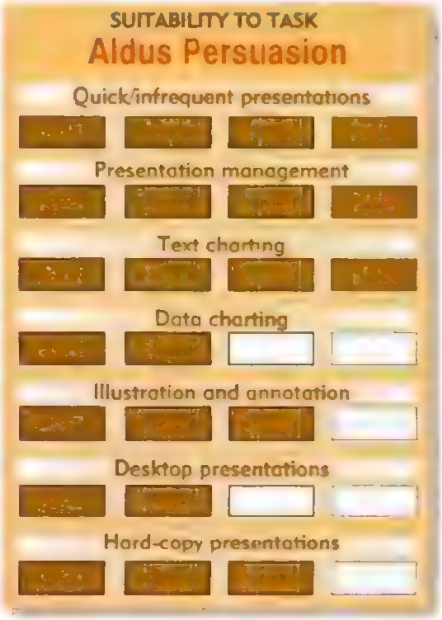
Aldus Persuasion

by Lori Grunin

When *Aldus Persuasion* is good, it is very, very good; but when it is bad, it is awkward. The $495 presentation graphics package suffers from a split personality in which the poor data handling plays the evil twin to superb presentation management and text charting.

The easy-to-use, *PageMaker*-like interface is composed of Microsoft Windows' traditional drop-down menus, tear-off dialog boxes, and iconized toolbars. You can select any element on the page and drag, resize, or recolor it.

Persuasion uses the slide master metaphor commonly found in the best presentation packages and ships with a broad set of predefined, attractive masters referred to as AutoTemplates. The package is relatively easy to understand straight out of the box, although a presentation graphics novice unfamiliar with *Persuasion*'s



At 600 x 600 dpi, the does wonders for any

HP LaserJet III with PostScript option: 300 x 300 dpi, max.

Courier
Courier Oblique
Courier Bold
Courier Bold Oblique
Times New Roman
Times New Roman Italic
Times New Roman Bold
Times New Roman Bold Italic
Helvetica
Helvetica Italic
Helvetica Bold
Helvetica Bold Italic
Helvetica Narrow
Helvetica Narrow Italic
Helvetica Narrow Bold
Helvetica Narrow Bold Italic

Times
Times Bold
Times Italic
Times Bold Italic
Univers
Univers Bold
Univers Italic
Univers Bold Italic

Sixteen scalable fonts, built in—twice as many as an HP LaserJet. And our fonts are Type-1. Theirs aren't.

IBM LaserPrinters

There's no end to the ways the new IBM LaserPrinters can make a body look good.

For starters, there's an Adobe® PostScript® option that delivers a true 600 x 600 dots per inch. It gives you up to *four times* the resolution of PostScript on any HP LaserJet® printer. Camera-ready output, on your desktop, for thousands of dollars less than ever before.

But the eye-catching advantages of the new IBM LaserPrinters aren't just for PostScript users.

LaserJet

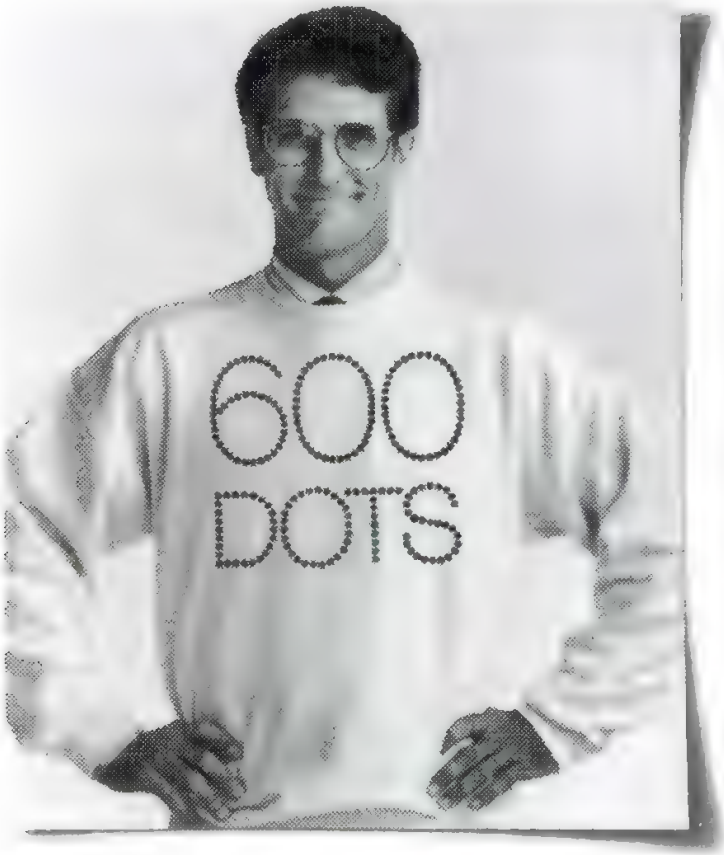
IBM

HP LaserJet jump-gap toner system vs. our contact-transfer. A clean win for the IBM LaserPrinter. (10 x enlargement)

600 x 600 dpi PostScript option available for LaserPrinter 6, 10 and 10L, requires 5MB total memory. Adobe and PostScript are registered trademarks of Adobe Systems Inc. HP and LaserJet are registered trademarks of Hewlett Packard Company. AppleTalk, Macintosh and Mac are registered trademarks of Apple Computer, Inc. IBM is a registered trademark of IBM Corp. in the United States and/or other countries and is used under license. Output produced with LaserPrinter 10 at 600 x 600 dpi. ©1991 Lexmark International, Inc.

THE NEW IBM LASER

new IBM LaserPrinter image. Especially yours.



IBM LaserPrinter with PostScript option: 600 x 600 dpi—up to four times the resolution.

Sixteen built-in scalable fonts are standard equipment—twice as many as the LaserJet III. They're Type-1 fonts with Adobe scaling technology, online and always ready, without waiting for downloads.

Also standard on every new LaserPrinter: crisper type and graphics than ever, thanks to sophisticated new Print Quality Enhancement Technology (PQET).

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Right from page one, the new IBM LaserPrinters make everything from simple correspondence to slick desktop publishing look crisp, clean, and cutting-edge.

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CIRCLE 024 ON READER SERVICE CARD

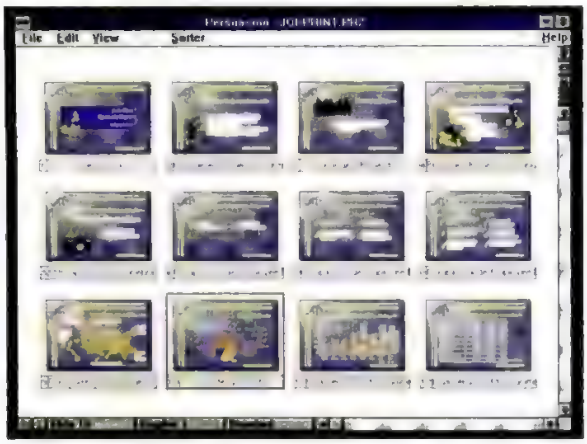
PRINTERS. PAGES AHEAD.

implementation of slide-master usage may stumble around a bit. Once you've grasped the master concept, as well as the distinction between the background masters and the chart masters, you'll find *Persuasion* a pleasure to use. The excellent documentation, including a great spiral-bound Desktop Reference, further enhance the software's usability.

The first time you launch *Persuasion*, it loads the user-selected default autotemplate and drops you into the word processor–style outline view. If you wish to reuse a set of masters from an existing presentation, you simply import them, with or without their palettes. Each level in the outliner corresponds with a placeholder on the master attached to that slide. To create a text chart, you can either type the text into the outliner, import a text file, or with a click of the mouse, jump directly to the slide view.

In the slide view, clicking on the text icon displays all the predesignated text blocks; you can enter text in one of these blocks or anywhere else on the slide. These placeholders control a wide array of text and paragraph formats, including text color, drop shadows, and word spacing. You can override the block placement by simply clicking on a block and dragging it.

Any text entered into a placeholder is bidirectionally linked with the outliner, which gives you the unique ability to create multicolumn charts straight from the outliner. The chart master controls the bullet types, and you can have a different bullet for up to six chart levels. Unfortunately, you must choose bullets from a typeface; since *Adobe Type Manager*, Version 1.15, which Aldus Corp. ships in the package, does not supply dingbats, you're basically forced to use the extended ASCII character set or symbol font for bullets.



***Aldus Persuasion*'s slide sorter displays thumbnail views of each slide and labels them with the slide titles.**

Persuasion offers a relatively robust set of drawing tools, including polygons and arcs. In addition to the de riguer *group* function, the package also has a nice regroup function that automatically groups recently ungrouped objects. Alternatively, you can place different pieces of a slide on different layers, which can be locked against edits and used for creating progressive builds during screen shows. The package ships with around 100 unattractive, almost uneditable, CGM clip-art images from MGI/IslandView; luckily, *Persuasion* seamlessly imports a large number of graphics file formats. The tear-off palette dialog box contains a working set of 16 colors, which you can easily modify, and at any time you have access to a total palette of 166 colors.

DEPRESSING DATA HANDLING

While it excels at almost every task it undertakes, *Persuasion*'s data charting leaves something to be desired. You can create a good number of attractive business charts with this package and have almost complete control over all aspects of their formatting, but Aldus *Persuasion*'s archaic and limited data handling makes the creation process a frustrating experience.

You can't select an entire spreadsheet for importing if that sheet has any named ranges; instead, the package forces you to separately import each range, restarting from the main menu each time. If you don't have any named ranges, you must manually enter the cell ranges for the imported data. The data sheet you create can only have the data you want included in a given chart; you can't select a range of data to graph. When creating a graph with overlays, such as a combination line and column chart, the overlay series must be the first series in the data sheet. Aldus will be adding OLE and DDE support in the next version of the product. Until then, anyone with serious data charting needs should think twice.

Aldus Persuasion
Aldus Corp., 411 First Ave. South, Seattle, WA 98104; 800-685-3539, 206-622-5500.
List Price: $495.
Requires: 2MB RAM (3MB recommended), 4.5MB hard disk space (13MB for all files), EGA graphics adapter, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: For mass production of text slides or highly stylized presentations, *Aldus Persuasion* can't be beat. The primitive data handling renders its data charting below par, however.

CIRCLE 465 ON READER SERVICE CARD

MIXED RESULTS ON OUTPUT

Once you've created your slides, it's easy to rearrange them using the slide sorter, which also gives you a black-and-white preview for monochrome output devices. The notes master is limited to one slide per page, but you can more flexibly customize the handout master and if necessary use that to create your notes.

Sending the presentation to different output devices is for the most part transparent. *Persuasion* printed the best-looking notes and handouts with little fuss and was among the best slide producers of the packages we tested here. *Persuasion*'s screen-show capabilities are good: You can choose one transition effect per presentation plus one transition effect for the layers on slides that use them as your defaults, then override them as you see fit. The next version of the package will contain a utility to play screen shows without loading the entire application.

Slide imaging isn't quite as simple as it could be, however. We had our slides processed by MagiCorp (*Persuasion* also comes with Autographix drivers), which supplies its own Bitstream fonts for imaging. Reworking the slides to change the ATM fonts is fairly simple, but ATM cannot generate screen fonts from the Bitstream outlines. In some cases it uses a generic font for screen display, but in many cases the typeface is rendered to screen as Greek (in other words, the program substitutes the Symbol font). MagiCorp includes a printed typeface sampler,

Come On In.

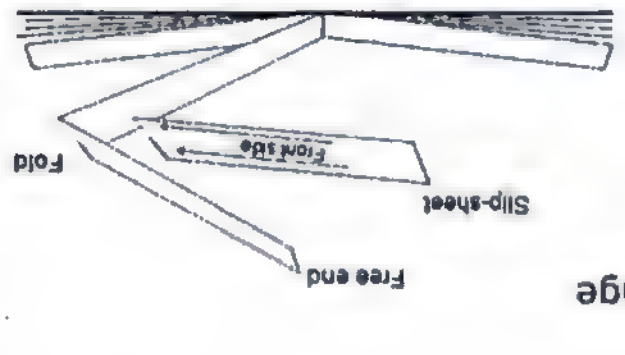
This ad was photographed at Archie's Diner in Sioux City, Iowa. Archie is behind the counter. Other characters are Gateway 2000 employees from departments throughout the company.

Folded edge of the page

GbsSlipSheet-001

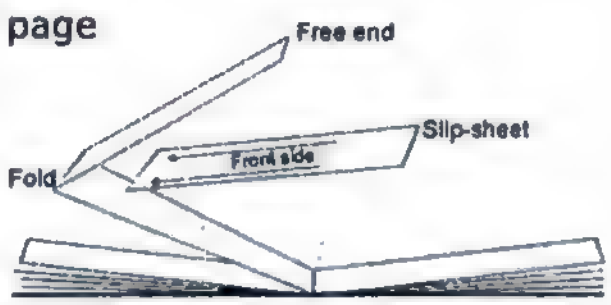
Foldout slip-sheet

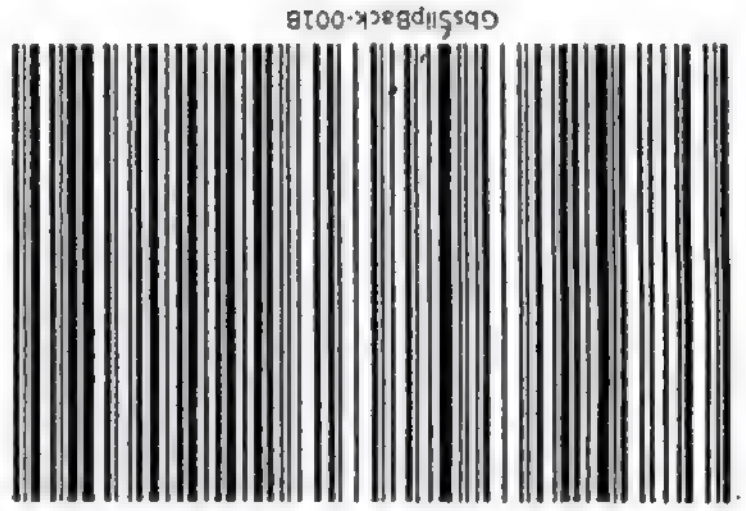
1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet





Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

Serving PCs
And yo
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Specialties Of The House
Hot Computers.
50's Prices.
Fabulous Service.
GATEWAY 2000
GATEWAY 2000

Gateway Cafe

What comes to mind when you picture the classic 50's diner?
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And the price on the check is remarkably affordable.

When you buy a personal computer from Gateway 2000, the experience has its similarities. You get a solid quality, high-performance computer that comes fully loaded with all the features you want. The service is unsurpassed anywhere. And the price you pay is also remarkably affordable.

You get a lot for your money at Gateway. And now you get even more. We're offering free application software with every system. Not just one or two popular programs either. You can choose from a smorgasbord of scrumptious software, prepared for use with Windows,™ and one selection comes free with your Gateway 2000 computer. We have new peripherals, too, including the Gateway TelePath™ – a 14,400 bps modem with 9,600 bps fax capability. The Gateway TelePath with WinFax Pro™ and Crosstalk® for Windows is only $195.

Go ahead and browse through the Gateway Cafe menu. We serve a wide selection of the freshest items in the PC industry. You're sure to find something that will appeal to your taste and budget.

GATEWAY2000

"You've got a friend in the business."

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Introducing A Sizzling Deal On

For $195, you get the Gateway TelePath– a new custom-designed V.32bis modem with full fax capability plus WinFax Pro,™ Crosstalk® for Windows™ and a free trial membership with CompuServe.® Anywhere else you'd pay more for the software alone!

The Gateway TelePath Fax/Modem

Gateway 2000's engineers designed this internal modem and fax card to incorporate everything our customers were hungry for in the arena of PC communications. Using the latest in VLSI technology, we cooked up a diet-sized card without the aftertaste.

Speed. The Gateway TelePath modem operates up to 14,400 bps. This alone is a 50% increase in speed over 9,600 bps modems and a 500% increase over 2,400 bps modems. But with V.42bis data compression, your effective data transfer rate can be even faster. The Gateway TelePath send/receive fax runs at 9,600 bps.

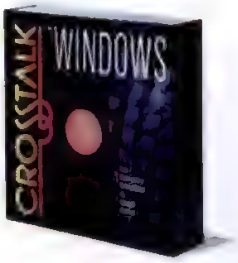
Compatibility. The 14,400 bps modem is compatible with the standard AT command set and can be used with almost any compatible software. The Gateway TelePath modem is downwardly compatible with lower modem speeds, so you don't have to worry about connecting – even with 300 bps devices. You'll connect reliably using data compression and error correction whether you're sending/receiving to the next office or the next continent. With the Gateway TelePath fax, you can send to or receive from any Group 3 or earlier fax machine using Class 1 or Class 2 commands.

Price. You'll find comparable fax/modem packages can cost in excess of $500 not including the software. Our customers expect a better price from Gateway 2000. At $195, the Gateway TelePath price is very easy to swallow.

The New Gateway TelePath

Ease of Operation. The Gateway TelePath comes with WinFax Pro 2.0, included in *PC Magazine's* Best of 1991 product roundup, and Crosstalk for Windows, version 1.2, the number-one-rated communication software. Other features include:

- Automatic speed sensing
- Programmable speaker volume control
- Fax mode: V.17, V.29, and V.27ter
- Data mode: (try to find one we don't support!) V.32bis, V.32, V.22bis, V.22, V.21, Bell 212A and 103, V.42 and MNP 2-4 error correction, V.42bis/MNP 5 data compression



Free CompuServe Trial Membership

In addition to the Gateway TelePath, WinFax Pro and Crosstalk for Windows, you also receive a free 30-day CompuServe membership. CompuServe is the nation's leading bulletin board service through which you can access volumes of information and services. Gateway 2000 provides technical information to subscribers through a special Gateway forum on CompuServe, as well as through Gateway's own BBS. All Gateway customers receive free memberships for the Gateway BBS.

$195

Peripherals, including the Gateway TelePath, are sold only with the purchase of a system. If you already own a Gateway 2000 computer, you can buy peripherals and components separately. For the fastest service, have your customer ID handy and ask for the sales upgrades and add-ons department when you call.

GATEWAY2000
"You've got a friend in the business"

New Video Options To Go With

The 15-Inch Crystal Scan 1572FS

It's bigger, but that's just one of the improvements we've made to the 15-inch Crystal Scan 1572FS. The new flat, square, non-glare screen reduces distortion around the corners and provides an edge-to-edge display area. At 1024 x 768 resolution, the non-interlaced Crystal Scan 1572FS has a higher 72 Hz refresh rate for added image stability and flicker-free display. Dot pitch is 0.28mm. The 1572FS will support resolutions up to 1280 x 1024, which prepares you for the future when this resolution becomes a standard.

We've also moved the fine tuning controls to the front of the monitor for easy access. Several controls that were previously inaccessible by the user, including horizontal and vertical sizing and positioning, are now conveniently located on the front bezel. Like the other Crystal Scan monitors, the 1572FS has an ergonomic tilt/swivel base.

The Crystal Scan 1572FS is an option with 386DX and 486 systems for an additional $195. Availability is limited. Your sales representative can tell you about several other tempting monitor options as well.

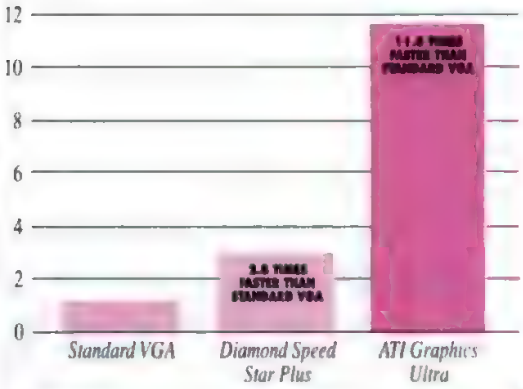
Your Gateway 2000 PC

The ATI™ Graphics Accelerator

You're really cookin' when you run a Gateway 2000 system with ATI's graphics accelerator, the Graphics Ultra. Load Windows. Almost instantly, it's there. Click on your desktop publishing application. Bang, it's there. With the Graphics Ultra, your PC suddenly performs like a graphics workstation.

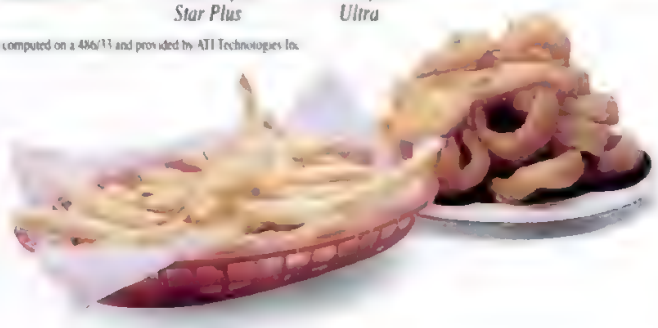
ATI achieves a quantum leap in performance by using a highly optimized graphics coprocessor. The 1024 x 768 mode is fully compatible with IBM® 8514, VGA, Super VGA and previous IBM graphics standards, which makes it easy to install applications using the standard video drivers provided with the software.

The ATI Graphics Ultra video card is standard with the 486-33 system, optional with other 386DX and 486 systems. The street price of this card is over $500, but with the purchase of a Gateway 2000 system, you can upgrade to it for $150!



Figures computed on a 486/33 and provided by ATI Technologies Inc.

Peripherals, including those featured on these pages, are sold only with the purchase of a system. If you already own a Gateway 2000 computer, you can buy peripherals and components separately. For the fastest service, have your customer ID handy and ask for the sales upgrades and add-ons department when you call.



GATEWAY2000

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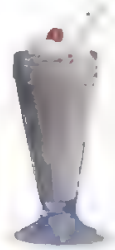
Gateway Cafe

Choose One Software Option Free With

With the purchase of any Gateway 2000 386SX, 386DX or 486 computer system, you now receive your choice of free application software. Pick one from the seven application options in our software buffet. We'll install one software option on your hard drive, optimally configured for your system and Windows,™ and provide you with the master diskettes and manuals – absolutely free.

You can also buy additional software at extremely competitive prices, or choose from other popular applications not listed here. Ask your sales person for details.



Option #1

Microsoft® Excel for Windows™ 3.0

- A powerful graphical spreadsheet program
- Includes online help for Lotus® 1-2-3® users
- *PC Magazine's* Editor's Choice

Retail value: $495. Discount value: $300+.
Can be yours free with a Gateway PC!

Option #2

Microsoft Word for Windows™ 2.0

- Best selling word processor for Windows
- New version 2.0 adds spectacular refinements
- Includes online help for WordPerfect® users

Retail value: $495. Discount value: $300+.
Can be yours free with a Gateway PC!

Option #3

Microsoft PowerPoint for Windows™ 2.0

- Easy-to-use desktop presentations program
- Creates high-quality overheads and 35mm slides

Retail value: $495. Discount value: $300+.
Can be yours free with a Gateway PC!

Option #4

Paradox® 3.5

- Award-winning database management program
- From Borland,® the leader in customer satisfaction for database and programming software

Retail value: $695. Discount value: $500+.
Can be yours free with a Gateway PC!

8 0 0 - 5 2

Your Gateway 2000 PC!

Option #5

The Entrepreneur Pack

Includes Microsoft's Works,™ Publisher™ and Money,™ the latest versions, and an Entertainment Pack, all for Windows, plus TurboTax for Windows™ from ChipSoft

- Works integrates a word processor, spreadsheet, database and more into one easy-to-use program
- Publisher has page layout tools to create publications
- Money helps you control your finances by writing checks, setting budgets, tracking expenses
- Entertainment Pack, eight games including Tetris'
- TurboTax is an easy-to-use tax preparation program with online help for understanding IRS rules

Retail value: $607. Discount value: $400+. Can be yours free with a Gateway PC!

This offer includes the identical applications contained in retail packages but will not include the retail box. You get a complete set of diskettes and manuals, shrink-wrapped and packaged in a Gateway 2000 box.

Option #6

The Windows Programmer Pack

Includes Microsoft's QuickC for Windows,™ Visual Basic for Windows,™ Windows Control Development Kit,™ MS Windows Help Compiler™ and MS Windows Programmer's Online Reference™

- Everything you need to create programs for Windows

You can't buy all of these tools in one package elsewhere, but this option can be yours free with a Gateway PC!

Option #7

Microsoft Project for Windows™ 3.0

- Flexible and easy project management program
- Includes interactive online tutorial
- *PC Magazine* calls it the best program in its category

Retail value: $695. Discount value: $425+. Or free with a Gateway PC!

If the free software packages offered here don't suit your needs, we have others that are very competitively priced. For example, if you'd rather get Microsoft Office,™ which includes Word for Windows, Excel and PowerPoint, you can upgrade to it. Office retails for $750, with a discount value of $499. It can be yours for only $175 with a Gateway PC. Ask your sales representative for details.

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Desserts SOFTWARE

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486 Systems

Gateway 2000's 486 systems run on the real McCoy – an Intel® 80486 processor with built-in math coprocessor and 8K instruction cache. The 486/33 has a Micronics® motherboard, while the motherboard for the EISA system is custom-manufactured for Gateway 2000. RAM is expandable to a system total of 64MB. New on the 486/33 is the ATI™ Graphics Ultra video card, which is the fastest video card by far in its class. The EISA model includes a Diamond Speedstar Plus,™ which is also a high-performance video card. Both systems come with 1MB video RAM.

The 486/33 has eight 16-bit slots on the motherboard, six available in the standard configuration. The EISA machine has eight 32-bit EISA slots on the system board, five open in our standard configuration.

The 486/33 has Phoenix® BIOS, while the 486/33 EISA uses Award® BIOS. Both systems come with Weitek sockets and 200 watt power supplies. These systems come standard in a desktop model. A tower model is an option for an additional $100.

The tower model is an option for 386DX & 486 systems.

33 MHz 486 Our best selling system, the 486/33, is now even better with the addition of the ATI Graphics Ultra video card. We use this system in our technical publications department where we produce 600-plus-page manuals, and the DTP people love it. That must be why *Computer Shopper* readers chose the 486/33 as the 1991 Best Buy in 486 desktop systems. The 486/33 comes with 8MB RAM and a 200MB hard drive. **$2945**

33 MHz 486 EISA With the 486/33 EISA, you can take advantage of Extended Industry Standard Architecture, capable of running the latest technology 32-bit boards, at an affordable price. If you're concerned about keeping up with technology, choosing EISA may be a smart move. This system includes a 32-bit EISA SCSI controller, an expensive option with most EISA computers, 8MB RAM and a hefty 340MB SCSI drive. **$3895**

Hungry For

386DX Systems

The 386 systems have a true 32-bit memory bus and more expansion capability. We start with a genuine Intel 80386 microprocessor on a Micronics motherboard. We add a generous portion of RAM – 4MB expandable to a system total of 64MB. Add IDE hard drives from Western Digital®, Diamond Speedstar Plus 16-bit VGA graphics cards with 1MB RAM, non-interlaced 14-inch Crystal Scan 1024 x 768 color monitors, Phoenix BIOS, a Weitek socket on the 33 and 200 watt power supplies. That's the basic recipe for these tried-and-true, workhorse computers.

Both systems have a 32-bit slot open in the standard configuration for RAM expansion. The motherboard has a total of one 32-bit and seven 16-bit slots, with one 32-bit and five 16-bit expansion slots available in the advertised configuration. These systems come in a desktop model that is roomy and easily accessible. A floor-standing tower model is an option for an additional $100.

25 MHz 386 The 386/25 is one of our most popular systems because it's a good Windows™ system and has plenty of power for most users' needs at a price that's very affordable. This system comes with 4MB RAM and an 80MB hard drive. **$1895**

33 MHz 386 The 386/33 was chosen as the Best Buy of 1991 for 386 desktop systems by the readers of *Computer Shopper* magazine. It's easy to see why. This is a powerful system, with 4MB RAM, 64K cache RAM and a roomy 200MB hard drive, at a price that's hard to beat. **$2395**

286 And 386SX Systems

Gateway 2000's 286 and 386SX systems come in a compact, mini desktop model. To give you plenty of room for expansion in a small footprint system, we integrated the diskette drive controller, the video chip set and the I/O card on the motherboard, leaving five 16-bit slots open in the standard configuration. The mini desktop models have a standard mouse port (PS/2® compatible), leaving two serial ports open. RAM on these systems is expandable to 16MB on the motherboard. The Western Digital IDE hard drives feature a 32K read-look-ahead cache buffer. All mini desktop models have Quadtel® BIOS and 200 watt power supplies.

16 MHz 286 If you're not a power user and don't care about using the full capabilities of Windows, the 286/16 could be the right machine for you. With 2MB RAM and a 40MB hard drive, it's a great value. This system received a 1991 Best Buy Award for 286 desktop systems from *Computer Shopper* readers. **$1345**

Gateway Cafe

16 MHZ 286

- 80286 Processor
- 2MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 40MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey™ Keyboard
- MS DOS® 5.0

$1345

16 MHZ 386SX

- Intel® 80386SX Processor
- 2MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 40MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey Keyboard
- Microsoft® Mouse
- MS DOS 5.0
- MS Windows™ 3.0
- Choice of Application Software

$1445

20 MHZ 386SX

- Intel 80386SX Processor
- 32K Cache RAM
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 80MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0
- Choice of Application Software

$1745

25 MHZ 386

- Intel 80386 Processor
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 80MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0
- Choice of Application Software

$1895

BEST BUYS

- Get our 33 MHz 386 system, same configuration as listed, with a 120MB IDE hard drive instead of the 200MB drive.

$2145

- Same features as our 33 MHz 486 system except this machine has 4MB RAM instead of 8, and a 120MB IDE hard drive instead of the 200MB drive in our standard configuration.

$2495

33 MHZ 386

- Intel 80386 Processor
- 64K Cache RAM
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 200MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0
- Choice of Application Software

$2395

33 MHZ 486

- Intel 80486 Processor
- 64K Cache RAM
- 8MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 200MB 15ms IDE Drive with 64K Multi-Segmented Cache
- ATI Ultra VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0
- Choice of Application Software

$2945

33 MHZ 486 EISA

- Intel 80486 Processor
- 128K Cache RAM
- 8MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 340MB 15ms SCSI Drive with 128K Multi-Segmented Cache
- 32-Bit EISA SCSI Controller
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0
- Choice of Application Software

$3895

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intel inside

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but without accurate screen fonts it's pretty much a "pick a face and see how the slides come out" proposition. Once the MagiCorp-specific presentation was prepared, however, using the Magicomm utility to create a disk for imaging was a snap.

For all its flaws, *Aldus Persuasion* still outshines most of the competition, and remains unbeatable for anyone who churns out a lot of long, text-dominated presentations.

POWER UP SOFTWARE CORP.

Express Presenter

by Tom Unger

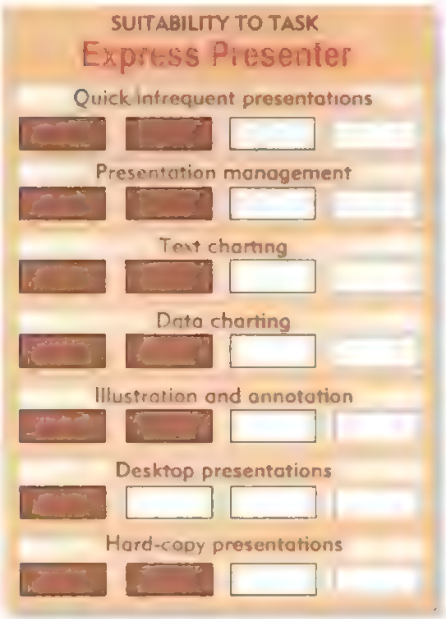
Power Up's presentation package is like a single cool drink on a hot day: It will wet your whistle, but it won't really satisfy your thirst. As a souped-up, considerably less expensive ($249.95) version of Business and Professional Software's *35mm Express* (reviewed in the *PC Magazine*, May 14, 1991, issue), *Express Presenter* provides an inexpensive but awkward entry into DOS-based presentation graphics.

Among *Express Presenter*'s strongest characteristics are those it shares with its Microsoft Windows–based brethren: slide and title sorters and an excellent storyboarding feature. You'll also find a host of predefined chart types. Unfortunately, in between chart choice and final output, *Express Presenter* suffers from an unsophisticated interface, limited file-import options, and deathly slow screen redraws.

CLUMSY INTERFACE

The program allows you to rough out your slides before delving into the minutia of individual slide building. Simply choose storyboard mode and enter text into a box next to each slide representation. This text can be used later as speaker's notes—a simple but effective method of organizing your presentation.

A Windows-like menu bar at the top of the work area allows you to pick and pull down a variety of menus, many that have their own sub and sub-sub-menus. Unfortunately, if your mouse's pointer strays off the narrowest menus, the menu disappears and you'll have to start over at the top pull-down menu. If you add the fact that many similar choices, such as move object and rotate object, are on entirely different drop-down menus, you have a recipe for design tedium and personal frustration. A Power Up representative says the company is working on improving and simplifying menu navigation.



Other, more minor deficits abound. For example, we found it relatively easy to complete our quick presentation within the required time frame—but not without some struggle. *Express Presenter*'s Quick-Start Guide fails to mention the proper steps for creating a master background chart, necessitating a search through the manual's reference section. Once over that hurdle, it's easy to create simple charts using a vertical gradient background fill. Making overlays to combine different types of charts is also quite easy.

Express Presenter uses three display modes. The data mode lets you add text line by line and define global text styles. You'll have to change to graphics mode for a WYSIWYG representation of your chart, which slows your efficiency in two ways. First, you can't move or edit text in graphics mode (although you can change such attributes as text size, style, or font), so you'll have to switch modes to edit. Second, every attribute change requires a full screen redraw and screen redraws are painfully slow, even on PC Magazine Labs' 386 25-MHz test machine.

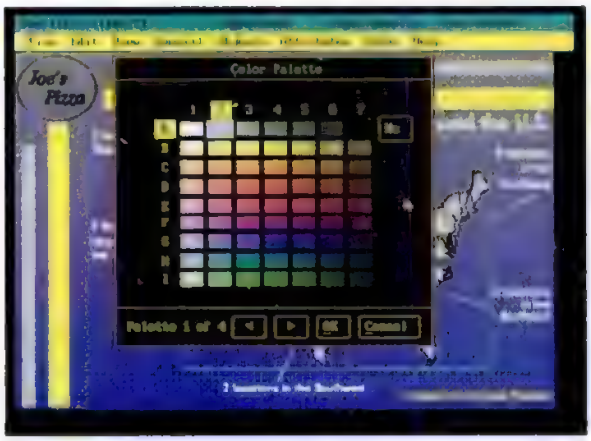
The eight screen fonts provided with the package are another source of disappointment. Not only are they hard to read at their smallest sizes, but you can only adjust them on a relative scale of 1 to 10; you can't size them in points. The program uses its own type-sizing scheme which determines type size relative to all the other elements of a chart. This may account for the extremely slow screen redraws, especially when there are more than ten text elements and objects on-screen.

The third mode, Annotate, lets you place CGM graphics and text as objects—an awkward process, indeed. The screen area lacks icons of any kind, forcing you to utilize the pull-down menus. There are no snap lines or grids incorporated to help you place and align an object, and even simple operations like adding lines is a tricky process.

LIMITED IMPORT

Express Presenter's outline chart won't pull in real outline files from word processors or dedicated outline packages. The ASCII import option does keep indented spaces when you import text, but requires you to set text line attributes manually in order to create your own outline.

On the other hand, pulling in worksheet data by range or individual cell is problem free. *Express Presenter*'s CGM import is also fairly robust—on our tests, it pulled text into the chart in a default font that was easily converted to a display font.



One slip of the mouse and this menu disappears! *Express Presenter*'s greatest drawback is its awkward interface.

Unfortunately, CGM import is all *Express Presenter* allows. The package does include about 400 scalable clip-art images, but this dearth of import options may put a crimp in your creativity. Power Up tells us that a future version will widen the import bottleneck.

In contrast, *Express Presenter* offers a wide range of file, print, and film recorder output formats. If you have a modem, you can send your slides to MagiCorp's overnight slide service. One note: If you plan to send slides via phone, be certain to shut off the error correction on your modem. *Express Presenter*'s built-in error correction will conflict with your modem's settings and prevent you from logging into MagiCorp's network.

On the whole, *Express Presenter*'s color and monochrome output is quite acceptable. The program's ability to produce a variety of output formats makes it a snap to turn slides into hard copy. *Express Presenter* queues each slide in the order you choose and will also produce speaker's notes and handouts.

If you're looking for a package with powerful overview features at a reasonable price, *Express Presenter* is certainly worth a test drive. But its abundance of preprogrammed chart types, slide and title sorters, and output formats are balanced by limited import options and an interface that may make you want to kick your computer in frustration. Consider waiting for the upgrade.

FACT FILE

Express Presenter
Power Up Software Corp., 2929 Campus Dr., San Mateo, CA 94403; 800-851-2917, 415-345-5900.
List Price: $249.95.
Requires: 640K RAM, 6MB hard disk space including all vector-based clip art, EGA graphics adapter, mouse, DOS 3.0 or later.
In Short: *Express Presenter* is like a Volkswagon with a Rolls Royce hood. It includes loads of export formats, title and slide sorters, and canned charts riding on an awkward, often frustrating interface. Its price is competitive, but it will have to improve before it wins the hearts of presenters who crave excellent output *and* ease of use.

CIRCLE 463 ON READER SERVICE CARD

GRAPHICS
PRESENTATION GRAPHICS

CHARTERSOFT CORP.

GraphShow

by Carol Levin

GraphShow, a new Microsoft Windows–based presentation package from Chartersoft Corp., stands out in two areas: Its $299.95 list price undercuts some competitors by up to $200, and its contemporary design lets you work directly on-screen. But what you gain in money you'll lose in time spent working around the program's first version flaws and the poor implementation of many of its features.

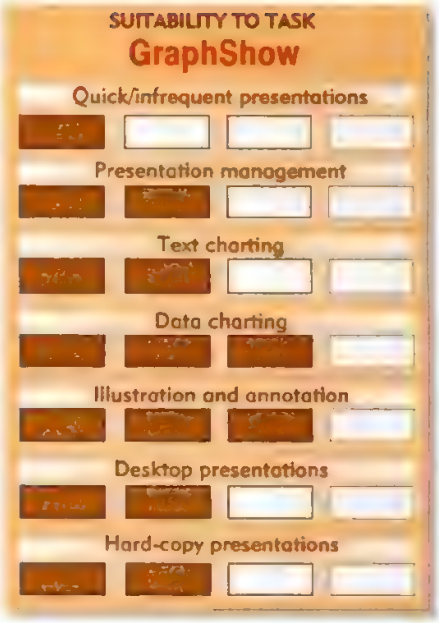
Designed to combine strong charting and drawing in one package, *GraphShow* doesn't claim to be the best of breed. It's missing some essential shortcut features, so it's less-than-ideal for building presentations in a crunch; it's also not particularly adroit at presentation management since it lacks such essentials as a slide sorter. Useful extras like an outliner, spellchecker, and the ability to generate speaker's notes are also missing from this first version.

SLIDES WITH DEPTH

GraphShow offers an easy master slide metaphor to help you design a consistent and efficient framework for an entire presentation, including, for instance, a gradient background and a company logo imported in a variety of formats. Any modifications you make to the master are immediately reflected in the slides, which are numbered sequentially in a convenient on-screen Presentation Control bar.

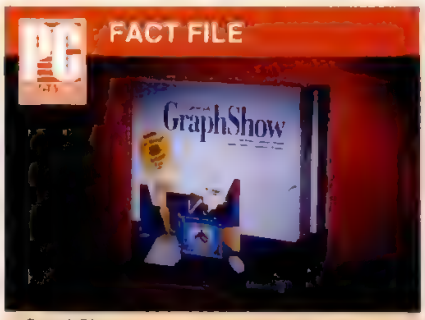
A multilayer structure lets you apply both a background and foreground to each slide, in addition to the master. Like other Windows programs that access the Clipboard, *GraphShow* makes simple work of copying and pasting objects—including clip art—between layers and slides.

But you won't find the full-blown templates offered by Lotus Development Corp.'s *Freelance Graphics for Windows* and Aldus Corp.'s *Aldus Persuasion* that make it easy to plug your material into predefined slide formats. Instead, *GraphShow* provides quasitemplates in the form of obscure icons (up and down arrows) on the text ruler that cycle through preformatted styles: heading, subheading, point, subpoint, and footnote. Essentially, you build your own chart by tagging each line of text with the appropriate style. *GraphShow*'s more structured, full-fledged organization chart builder supplies a complete worksheet editor and a variety of branch styles.



Chartersoft has paid particular attention to letting you directly manipulate all text and objects: You can apply a complete set of formatting commands and enter user-defined point sizes to the 17 PostScript typefaces bundled with *Adobe Type Manager;* select axis tick labels and adjust size, style, and color; reposition a

FACT FILE

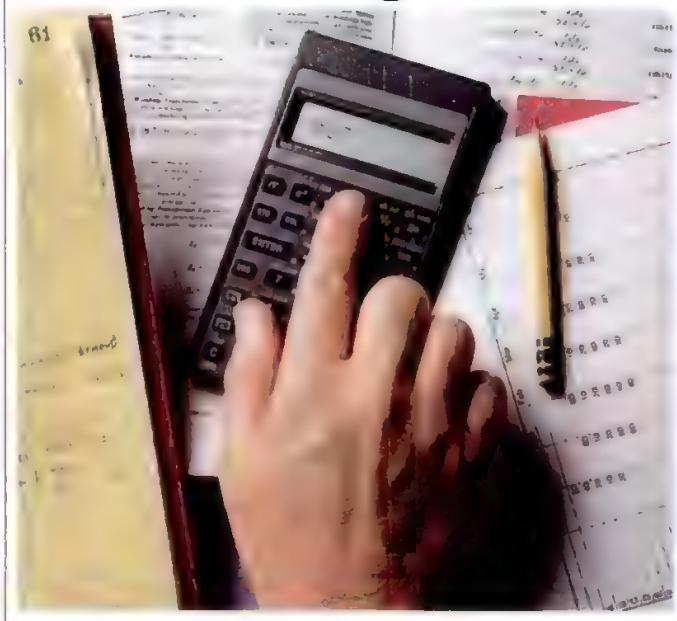


GraphShow
Chartersoft Corp., 80 Fennell St., Winnipeg, Manitoba, Canada R3T 3M4; 800-665-4444, 204-453-4444.
List Price: $299.95.
Requires: 2MB RAM, 2.5MB hard disk space, EGA graphics adapter, mouse, DOS 2.1 or later, Microsoft Windows 3.0 or later.
In Short: There are plenty of features in the jazzy *GraphShow* package, but you'll have to work around some inevitable first-version flaws and poor implementation to put them to work. This promising newcomer needs some tweaking in the usability and responsiveness categories to make it a top-notch competitor.

CIRCLE 457 ON READER SERVICE CARD

There are two ways to do your math.

Drag. Click-n-drag.



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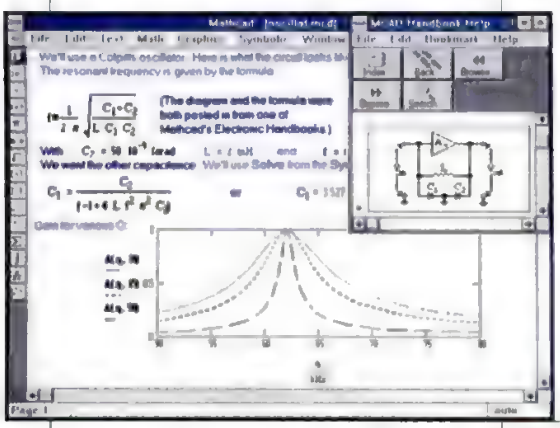
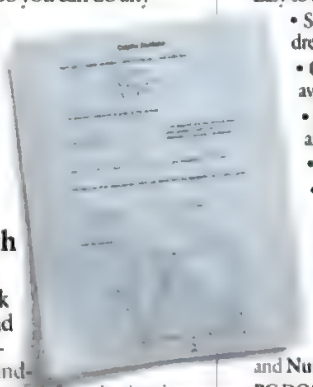
Mathcad 3.0 is much more than just a number-cruncher. It's an integrated math *system* that performs everything from addition to symbolics—easily and naturally. Because it works the way you think.

Just type your calculations anywhere on the screen—just like a scratch pad—and you're done. Mathcad does the calculating. Updates answers when a variable changes. Graphs in 2-D or 3-D. Even accepts bitmapped graphics.

A quick menu pick gives you full symbolic calculation capabilities. So you can do any integral, Taylor series, or infinite sum with click-n-drag simplicity.

Done calculating? Mathcad prints out presentation-quality documents complete with equations in real math notation.





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For a wider range of ready-to-use formulas and data, you can order additional Electronic Handbooks, created with the leading publishers of technical reference handbooks. Or optional Applications Packs with modifiable templates for all major engineering and science fields.

160,000 people already rely on it.

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- Easy to use symbolic calculations
- Standard Electronic Handbook with hundreds of useful built-in solutions
- Other optional Electronic Handbooks available
- Differentials, FFTs, cubic splines, matrices and more
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PC MAGAZINE EDITOR'S CHOICE

Mathcad 2.5
3-14-89 issue.
Best of '88
Best of '87

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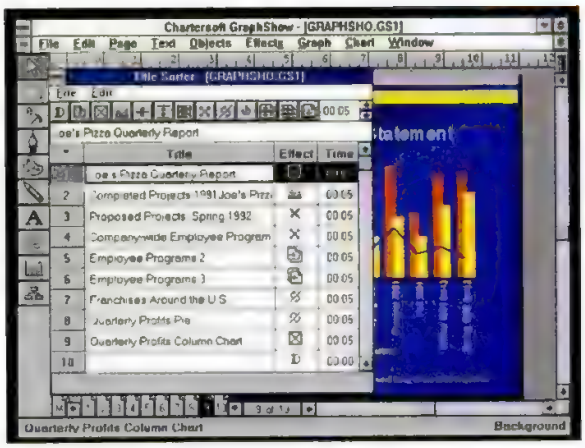
CIRCLE 154 ON READER SERVICE CARD



You can access *GraphShow*'s title sorter window at any time by clicking on an icon in the upper right corner. The Presentation Control bar along the bottom provides quick access to complete slides.

legend by clicking and dragging; and click on bars, columns, or pie slices to change colors.

But fussy mouse behavior tends to weigh down some of these advantages. Click on an object or text for repositioning, and the program cycles through three options: rotation/skewing, cropping, and selecting an object. While convenient for manipulating objects, the rotation option makes it too easy to unintentionally stretch or condense text—irreversibly at that, because *GraphShow* can only undo cut, copy, paste, and clear commands, not attributing. And both of *GraphShow*'s text tools are more strict than *Freelance*'s text tool, which lets you select text and attributes in any order. *GraphShow*'s text icons tend to stubbornly revert back to their default color and size each time you use them.

CHARTING FOR BUSINESS

GraphShow offers a Graph Gallery filled with fully customizable business graphs and neatly imports a variety of data formats. By maintaining links with the underlying .GSW worksheet, graphs are automatically updated with worksheet changes. But the program does not support Windows DDE and cannot import named ranges.

Three-dimensional chart enhancement options are especially strong: Parallel and perspective views are available, and you can even specify a degree for the rotation angle. You can combine charts in a variety of pairs to emphasize points and scale them using either linear or logarithmic methods, but the program does not offer the more advanced technical charts.

GraphShow has a complete, advanced repertoire of vector drawing tools, including a variety of line and line-end styles, bezier curves, and polygons. Its sophisticated fine-tuning techniques let you reshape polygons, snap or align objects, blend the color or shape of one object into another object, and more. You can even mix your own colors using RGB or HLS mixing schemes and create your own background gradient by specifying a focal point.

These top-notch drawing techniques, though, come at the expense of easy accessibility to essentials. Placing and repositioning simple bullets is needlessly complex and limited, and line end-styles are sometimes difficult to apply. There's only a single palette of 77 colors, and the range and quality of the clip art is only adequate.

WINDOWS' OUTPUT ADVANTAGE

After the final touches, you can use *GraphShow*'s title sorter to rearrange slides, apply transitions, and set durations. Linear slide shows run on a PC loaded with the entire program (there's no runtime module). You can also save presentations as EPS, PS, or SCODL files for slide service processing (you have to send disks since there's no communications program) or print to any Windows-supported printer or film recorder. Unfortunately, the program falls short in convenient support from slide service bureaus. As of this writing, Chartersoft is working with MagiCorp on a driver for slide output but only Management Graphics of Toronto currently supports *GraphShow*.

In our tests, color PostScript output and LaserJet output were comparatively fast and uneventful. LaserJet output was not as sharp as color PostScript output, though, since we were unable to print at 300-dot-per-inch resolution. The gradient dropped out of the background on slide output, and an imported .WMF file and a chart legend also disappeared, problems that the new SCODL driver and MagiCorp support should eliminate.

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

List price

GENERAL FEATURES

Interface

DOS applications:
- Expanded memory
- Extended memory (not HIMEM)
- Virtual memory

Microsoft Windows applications:
- Real mode
- Standard mode
- 386 Enhanced mode

Supports mouse
Supports math coprocessor

NETWORK SUPPORT

NetBIOS
NetWare
LAN Manager
Runs from server
Shares network printers
File sharing and locking

WORD-CHARTING FEATURES

Bullet lists
Numbered lists
Progressive build
Multicolumn tables
Maximum number of rows, columns
Free-form text (labels)
Word-wrap text boxes

TEXT-HANDLING FEATURES

Font support:
- Preformatted raster fonts
- Scalable fonts supplied
- Font types supported
- Range of point sizes
- Scientific symbols and Greek letters
- Supports printer fonts
  - HP cartridge and soft fonts
  - PostScript

Text alignment and style options:
- Align text on baseline
- Indent text
- Left/center/right text alignment
- Full justification
- Set text margins
- Shrink text to fit box
- Expand box to fit text
- Rotate text
- Adjust line spacing (leading)
- Adjust word spacing
- Adjust letter spacing (kerning)

Spell-checker

N/A—Not applicable: The product does not have this featur

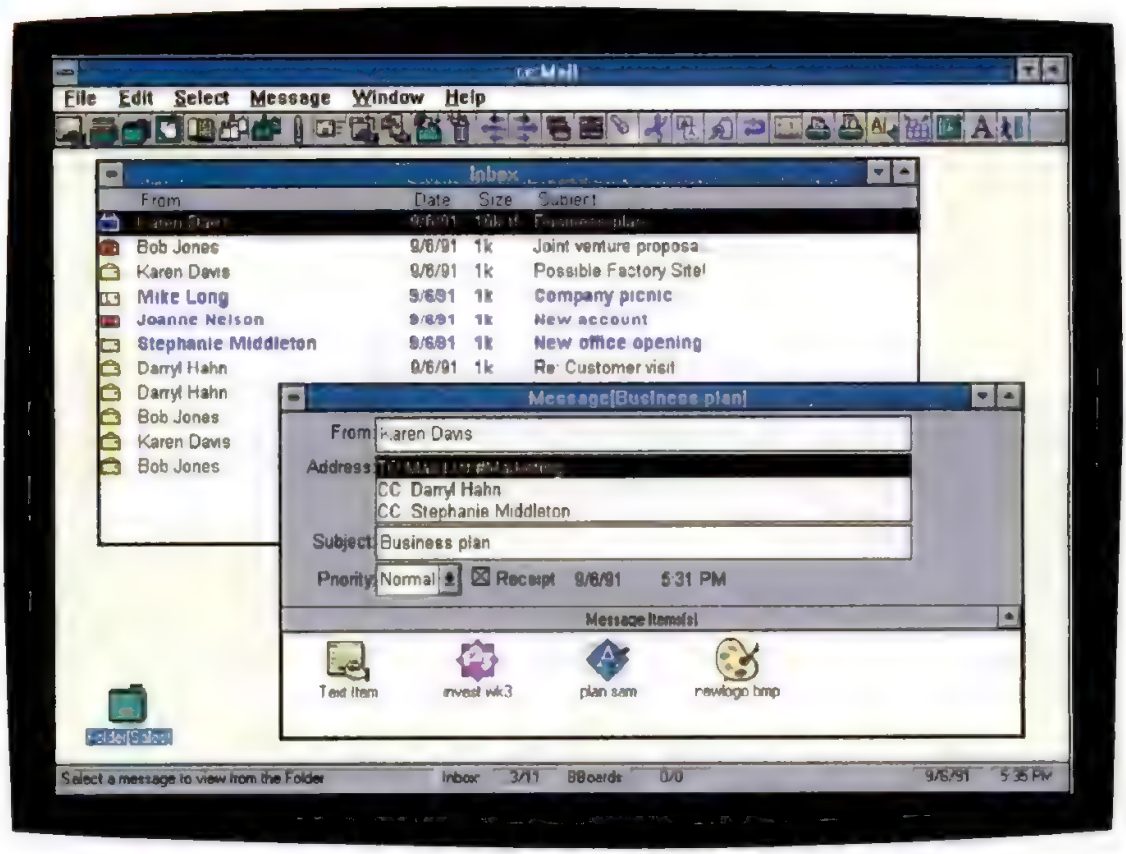
Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
$495.00	$199.00	$495.00	$499.00	$249.95	$495.00	$495.00	$299.95	$595.00	$495.00
Microsoft Windows	Microsoft Windows	Microsoft Windows	Microsoft Windows	DOS graphics mode	DOS character mode	Microsoft Windows	Microsoft Windows	DOS character mode	Microsoft Windows
N/A	N/A	N/A	N/A	❑	■	N/A	N/A	■	N/A
N/A	N/A	N/A	N/A	❑	❑	N/A	N/A	❑	N/A
N/A	N/A	N/A	N/A	❑	■	N/A	N/A	■	N/A
❑	❑	■	■	N/A	N/A	❑	■	N/A	■
■	■	■	■	N/A	N/A	■	■	N/A	■
■	■	■	■	N/A	N/A	■	■	N/A	❑
■	■	■	■	■	■	■	■	■	■
❑	❑	■	❑	❑	❑	■	■	❑	■
■	❑	■	■	❑	■	■	■	❑	■
■	❑	■	■	❑	■	■	■	■	■
❑	❑	❑	❑	❑	■	❑	■	❑	■
■	■	■	■	❑	■	■	❑	■	■
■	■	■	■	■	■	■	■	■	■
■	❑	■	■	❑	■	■	❑	❑	■
■	■	■	■	■	■	■	■	■	■
❑	❑	❑	■	❑	❑	❑	❑	■	■
■	■	❑	■	■	❑	❑	❑	■	❑
■	■	■	■	■	■	■	■	■	❑
256, 256	8, 12	16, 384	Unlimited	30, 13	120, 30	4,000, 26	Unlimited	24, 24	N/A
■	■	■	■	■	■	■	■	■	■
■	■	■	■	❑	■	■	■	■	■
❑	■	■	❑	■	■	■	❑	■	❑
13	11	41	9	8	9	13	17	22	3
Adobe Type 1	Nimbus Q	Adobe Type 1, Bitstream	Adobe Type 1, Bitstream	Proprietary, Agfa	Bitstream (Speedo)	Adobe Type 1	Adobe Type 1	Proprietary, Bitstream	Bitstream (Fontware)
2–2,000	Unlimited	1–144	Unlimited	1–47	Unlimited	2–2,000	Unlimited	N/A	1–127
■	■	■	❑	❑	■	❑	❑	■	■
■	❑	■	■	■	■	■	■	■	■
■	N/A	■	■	❑	■	■	❑	■	■
■	N/A	■	■	■	■	■	■	■	■
■	■	■	■	❑	■	❑	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	❑	■	■	■	■
■	■	■	❑	■	■	■	■	■	■
❑	❑	■	❑	■	■	■	■	■	■
■	❑	■	■	❑	■	■	■	■	■
■	❑	■	■	■	■	■	■	■	❑
■	■	■	■	■	❑	❑	■	■	■
❑	❑	❑	❑	■	❑	❑	■	❑	❑
■	■	❑	■	■	❑	❑	■	❑	❑
■	■	❑	■	■	■	■	❑	■	■

CONTINUES

Why is cc:Mail the lea

cc:Mail is so easy to install, learn and use, you can have your electronic mail system up and running quickly.

cc:Mail can send information across all of these computing platforms to reach everyone in your organization.



Over a million satisfied customers have already given cc:Mail a first-class rating. For example, Windows users love its easy-to-use interface, SmartIcons™ and application integration. And PC World *says "Sending a cc:Mail message is easier than addressing an envelope and licking a stamp."* 9/91*

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ding e-mail package?

cc:Mail is built on a state-of-the-art, third generation architecture which means your mail system will grow as your company grows.

It's easy to see why cc:Mail™ from Lotus® is the world's leading electronic mail package. Because it delivers more than messages. It handles just about any electronic mail need you might have. No matter how large or small your workgroup is. With it you can send text, files, graphics and faxes across all major local area networks such as Novell,® LAN Manager and Banyan.® Without needing new hardware.

cc:Mail

Better still, it allows you to send electronic mail effortlessly back and forth from different platforms—such as DOS, Windows™ 3.0, OS/2® and Macintosh®—across the same LAN. Plus, with cc:Mail you can access public mail and even mainframe mail quickly and easily.

LAN TIMES READERS CHOICE 1990 1991

Our newly released cc:Mail for Windows takes full advantage of Windows 3.0. Support of Dynamic Data Exchange lets you easily send other mail-enabled Windows files from within those applications. For example, you can send a report you've written with Ami Pro™ for Windows across the country while the application is still on your desk top.

Plus, cc:Mail is the first package of its kind to take advantage of a new, fully scalable messaging architecture. This means cc:Mail will grow along with your business. Whether you're adding six new users, 6,000 or 60,000, cc:Mail is a proven solution. As *PC World* has said, "It's clearly a best buy." *PC World*, 9/91*

For a free demo disk of the cc:Mail Macintosh, Windows or DOS Platform Pack of your choice, call us today at **1-800-448-2500.**

You can send a file from any mail-enabled application, such as 1-2-3® for Windows and other industry leading software programs without leaving the application.

Keep things running on time with cc:Mail's advanced integrated calendaring and scheduling option.

cc:Mail from Lotus

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It's been 59 years since anyone's felt this confident in front of a crowd.

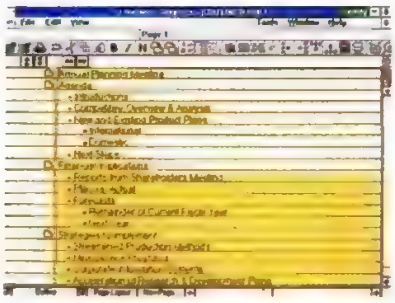
In the 1932 World Series, with the Cubs riding him unmercifully, Babe Ruth calmly pointed to the centerfield bleachers as if to predict the flight of the ball. On the next pitch, he hit it where no ball had been hit before.

Now your next presentation can be a big hit.

Now you can be more confident your next presentation will be as big a hit as Babe's. Because the new Freelance Graphics™ for Windows™ does most of the work for you.

The fun begins with QuickStart, an animated on-line tutorial that coaches you—step-by-step—through the process of creating a stunning presentation.

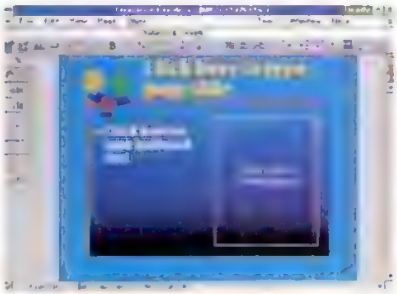
Freelance Graphics also features SmartMasters™ that automatically manage the design of your presentation. Smart Charting automatically composes data charts to fit the available space. And the Symbol Gallery offers you over 500 full-color clip art images. Of course, Freelance Graphics is fully integrated with all our Windows products. And it features SmartIcons,™ the unique "one-click" short-cuts for automating frequent tasks.



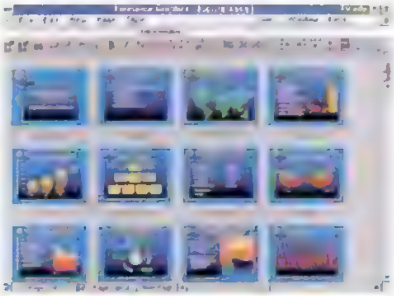
Use this view to outline your points. As you type, SmartMasters create presentation pages for you automatically.

So, let Freelance Graphics, your presentation partner, guarantee your success from start to finish.

1. Select the look. And let SmartMasters do the design work for you. Of course, you can still customize the look any way you choose.



2. Fill in the blanks at the prompts. Add your message or place your graphs where indicated on the screen.



3. See the big picture in Page Sorter. Add, delete, rearrange or combine pages from other presentations and you're ready to go.

And your next pitch could be your most memorable.

To purchase Freelance Graphics for Windows, contact your Lotus Authorized Reseller today. For a free auto demo or to upgrade, please call 1-800-872-3387, ext. 6486.*

Freelance Graphics for Windows

Lotus

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While the first version of *GraphShow* suffers from Windows Unrecoverable Application Errors, the odd error message and a reference manual that's too brief, *GraphShow* is a promising first effort. If Chartersoft follows through by paying more attention to the details of usability and making the program responsive in a crunch, *GraphShow* has the potential to be a strong contender among Windows-based presentation graphics packages.

COMPUTER ASSOCIATES INTERNATIONAL INC.

CA-Cricket Presents

by Wendy Dugas Pérez

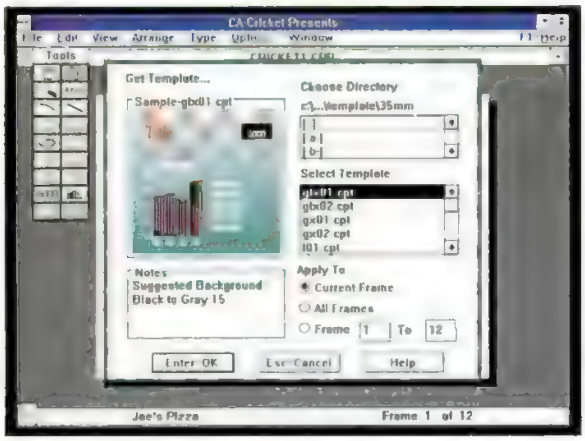
Balancing features against price is never an easy task. In the case of *CA-Cricket Presents*, Computer Associates International chose to stack the scales on the price side, creating a WYSIWYG Microsoft Windows presentation graphics package with only minimal graphing options, but at a rock bottom price of $199. For fuller graphing capabilities, the company will direct you to *CA-Cricket Graph* ($129); the two products together cost less than most one-box presentation graphics solutions, but add extra work to the creation process.

CA-Cricket Presents uses a standard Windows interface, but it looks like Windows 2.*x*: this program features none of the fancy push-buttons of its pricier brethren. Like those packages, though, *CA-Cricket Presents* stores all of the frames (or slides) for a presentation in a single file and automatically generates handouts and speaker's notes, although there aren't many customization options. For example, any notations made on the first page are reflected on all of the handout pages, and you cannot reposition the slides on your handouts or speaker's notes. One easy task though, is rearranging frames, which can be done by simply grabbing and moving them in either the title or slide sorter views.

CA-Cricket Presents has a fairly robust toolbox, which includes rounded rectangles, borders, and diamonds. You can edit any of the 256 colors in the master palette using RGB and HLS color models to create your own active palette.

Presents offers only the most basic graph types. While the package doesn't automatically generate combination graphs, it does allow you to overlay graphs, thus achieving the same affect—albeit with more work. Other features missing from its graphing options are exploding pie slices and the option to supress the printing of percentages next to pie slices (or at least to modify their decimal places). The graphing is even further limited by the small size of the data sheet. Graphs are limited to only 20 points in each of four series while tables can only have a maximum of eight rows and 12 columns. You can only perform the most basic chart formatting, like changing fonts and colors, and since you cannot separate legends and titles from graphs, you are stuck with where the package places them.

Data handling introduces more problems. The package can't import named ranges and it doesn't link to any spreadsheets. You can't select noncontiguous data or have any blanks in the columns and rows, which means you will need to do a substantial amount of cutting and pasting to successfully import your data.



Like most packages, *CA-Cricket Presents* lets you use templates to automate the slide-creation process. A *Cricket* template can include objects, graphs, and text.

DESIGNING YOUR PRESENTATION

CA-Cricket Presents lets you create what it calls a common background; this can include text, color, objects, or graphs. The program also provides you with the ability to use templates, which can include objects, graphs, or text. You can

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ⌋—No

BUSINESS CHARTS	
Chart gallery	
Chart stylesheets	
Horizontal/vertical bar charts:	
Plain	
Stacked	
Overlapped	
Clustered	
Shadowed 3-D	
Projected 3-D	
True 3-D	
Maximum number of bars per chart	
Pie charts:	
2-D	
3-D	
Specify 3-D viewing angle	
Specify 3-D pie thickness	
Maximum number of slices	
Explode slices	
Yank and place slices	
Multiple linked pies	
Proportional pies	
Line and scatter plots:	
Line plots	
Number of line styles	
Scatter plots	
Number of point symbols	
Area charts:	
Unstacked	
Cumulative	
Stacked (area total)	
Stacked (100 percent area)	
Combination charts:	
Line over bar	
Line over area	
Hi-lo over bar	
Pie with bar	
Miscellaneous charts:	
Hi-lo-open-close	
Organization	
Histogram	
TECHNICAL CHARTING FEATURES	
Technical scaling options:	
Semi-log (*x*-axis or *y*-axis)	
Log-log	
Multiple axes	
Curve fitting	
Error bars	
Summary statistics	
Data smoothing	

N/A—Not applicable: The product does not have this feature

Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	❑
■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
❑/❑	❑/❑	■/■	■/■	■/■	❑/❑	❑/❑	■/■	■/■	■/■
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■/■	❑/❑	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
■/■	❑/❑	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
❑/❑	■/■	■/■	❑/❑	■/■	❑/■	❑/■	■/■	■/■	❑/❑
256	80	Unlimited	Unlimited	60	140	104,000	Unlimited	16,000	128
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
❑	❑	■	❑	■	■	■	■	■	■
❑	❑	■	■	■	■	■	■	■	■
32	20	Unlimited	Unlimited	12	16	16	Unlimited	24	128
■	❑	■	■	■	■	■ (2-D only)	■	■	■
■	❑	■	❑	❑	❑	❑	❑	❑	■
❑	❑	■	■	❑	■	■	■	■	❑
❑	❑	■	■	■	❑	❑	■	■	❑
■	■	■	■	■	■	■	■	■	■
10	80	8	Unlimited	1	8	5	6	3	3
■	■	■	■	❑	■	■	■	■	■
12	16	10	4	N/A	9	10	Unlimited	13	10
■	❑	■	■	■	■	■	■	■	■
■	❑	■	■	■	❑	■	■	■	■
■	■	■	❑	■	■	■	■	■	■
■	❑	■	■	■	❑	❑	■	■	■
■	❑	■	■	❑	■	■	■	■	❑
■	❑	■	❑	❑	❑	❑	■	■	❑
■	❑	■	❑	❑	❑	■	■	■	❑
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■	❑	■	❑	❑	■	■	■	■	■
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❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
■	❑	■	❑	❑	■	■	■	■	■
■	❑	■	❑	❑	■	■	■	■	■
■	❑	■	❑	❑	■	■	■	■	❑
❑	❑	■	❑	❑	■	■	❑	■	❑
❑	❑	❑	❑	❑	❑	❑	❑	■	❑
❑	❑	■	❑	❑	■	❑	❑	■	❑
❑	❑	■	❑	❑	❑	❑	❑	■	❑

CONTINUES

create your own templates or use those included in the package that are geared toward your output medium, but don't expect anything fancy. You can use multiple templates on a slide and the program will automatically update your slides to reflect changes to the background.

The program's text charting is a big improvement over its graphing capabilities. You can create bullet charts easily either by using templates or by enabling the bullet selection on the menu. You edit the bullet characters, color, and size through the paragraph specification dialog box. Although *CA-Cricket Presents* can't automatically create shadowed text, you can use the duplicate feature to create drop shadows. This is a relatively simple multiple-step process that other packages handle with one step.

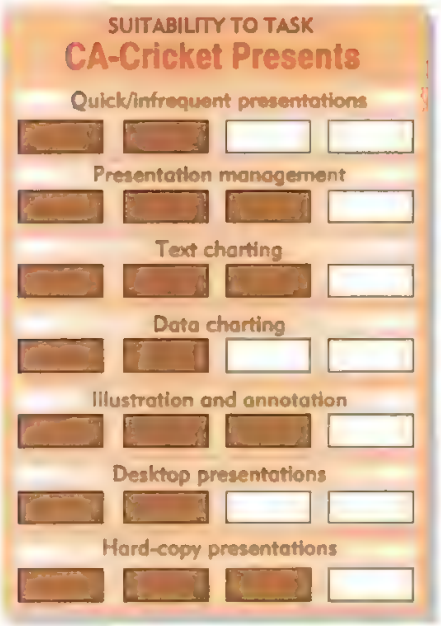
A LITTLE SOMETHING EXTRA

CA-Cricket Presents comes with CA-Abstract, an outliner that lets you easily type in your text, or take the more complicated approach of importing files through the Windows Clipboard. If you choose this option, you will end up doing a lot of cutting and pasting to get it into the form that CA-Abstract needs, though. The Auto Presents command allows you to merge outlines and templates, but any changes you make to the outline after merging will not be reflected in your presentation.

The package has several different output capabilities, one of which is a fairly robust screenshow with 14 different transition effects. Printing, whether by LaserJet or color PostScript printer, is a slow task. We experienced some problems when printing out hardcopies of our presentation, as well as the handouts and speaker's notes that the package automatically generates. For example, when you change output devices after your presentation is created, the package can not automatically resize text, and if you don't go in and select each text box on all of your slides, *CA-Cricket Presents* can't align it properly either. Also, it cannot print TIFF images to PostScript, which unfortunately, is how you generate slides.

The Autographix slide driver is not included in this version of the program; instead, you receive a voucher you must send to Autographix to receive the slide kit. This includes the communications software, the Autographix driver, and a manual, and although it is free, this extra step doesn't help if you need to get up and running quickly. The process for imaging slides is easy, and our end result was good-quality slides.

CA-Cricket Presents gives you the basic tools to create effective presentations, although it may take you a little longer to do so. And while it's missing some of the sophistication of the other packages, especially in its data-graphing capabilities, you can still accomplish your goals. Its $199 price tag makes it a bargain for those who can live without these extras.



CA-Cricket Presents
Computer Associates International Inc., 711 Stewart Ave., Garden City, NY 11531; 800-645-3003, 516-227-3300.
List Price: $199.
Requires: 2MB RAM (4MB recommended), 2MB hard disk space, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later. EGA graphics adapter recommended.
In Short: Priced at $199, this package represents the biggest bargain in presentation graphics, but what you gain in savings, you lose in features. Don't expect more than minimal graphing capabilities from this package or any of the sophistication of its pricier competitors. *CA-Cricket Presents* is capable, but basic.

CIRCLE 486 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes □—No

DATA-HANDLING FEATURES

Data import file formats:
- ASCII
- .DBF
- DIF
- SYLK
- WK1
- XLS (*Microsoft Excel*)
- .XQS (*Quattro Pro*)

Maximum number of data points per series
Maximum number of data series per chart
Maximum number of data points per chart
Maximum number of series in data sheet
Imports named ranges

User can select noncontiguous data
Ignores blank rows and columns
User can rearrange rows and columns
Math functions in data sheet
Data transformation by function

Data linkage:
- Chart links to data sheet
- Live links to external worksheet
- Supports DDE
- Supports OLE

Imports *Lotus 1-2-3* charts
- Preserves data link

Imports *Microsoft Excel* .XLC charts
- Preserves data link

CHART-EDITING FEATURES

Place, move, and edit charts interactively
Chart titles
Axis labels
Data labels

Legends
Text annotations
Arrows
Insets
Edit text directly on chart

Resize chart
- Scale to fit
- Preserve aspect ratio

Rotate chart

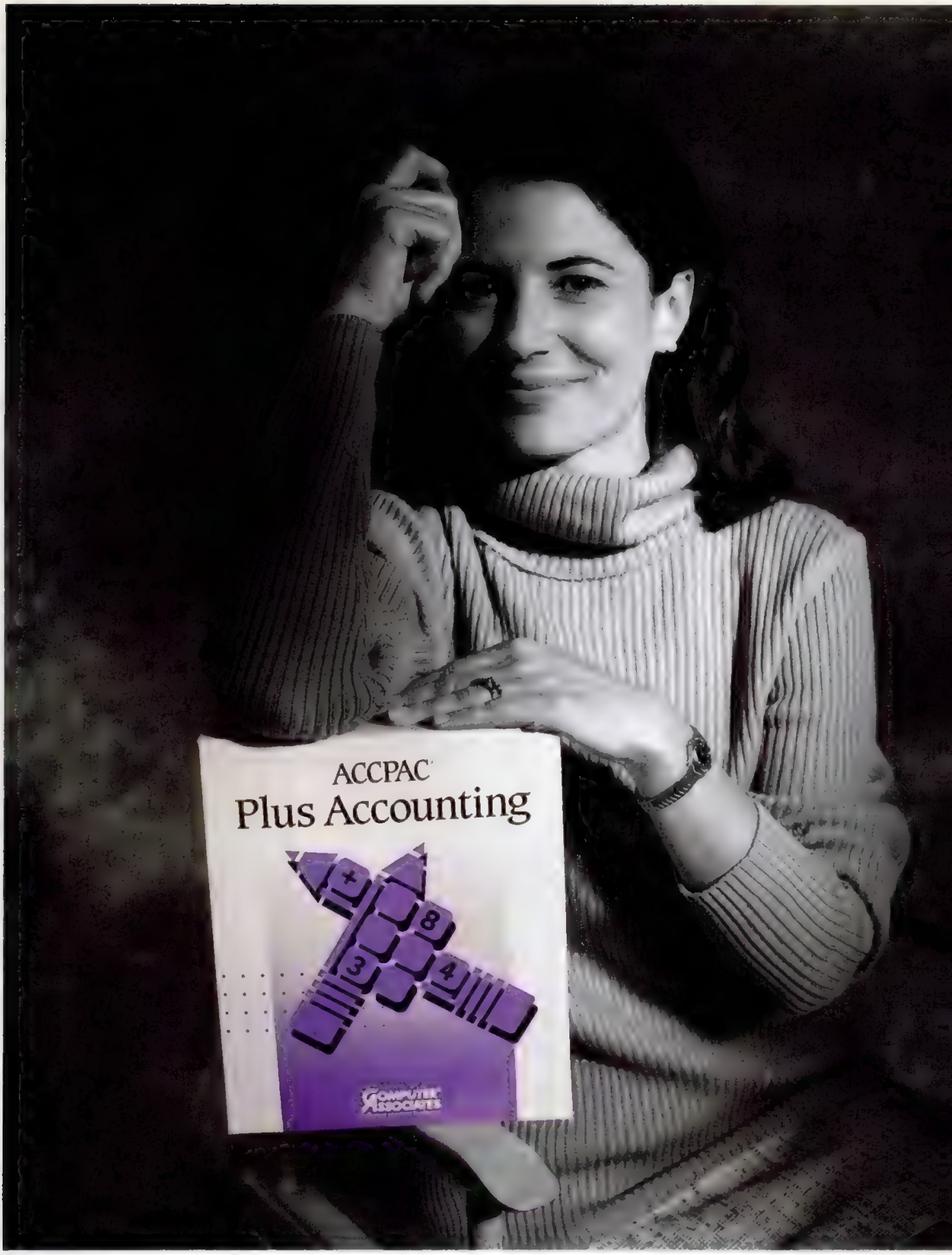
Chart options:
- Multiple charts per slide
- Show grid
- Multicolumn legends
- Calculate and show data percentages

Number of predefined fill patterns
User-definable fill patterns

N/A—Not applicable: The product does not have this feature

Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
■	■	■	❑	■	■	■	■	■	■
■	❑	❑	❑	❑	■	■	❑	■	■
❑	■	❑	❑	❑	❑	■	❑	❑	■
■	■	❑	❑	❑	■	■	❑	❑	■
■	■	■	■	■	■	■	■	■	■
■	❑	■	■	❑	❑	❑	■	■	■
❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
256	20	Unlimited	Unlimited	60	500	104,000	Unlimited	1,000	127
256	4	Unlimited	Unlimited	12	8	104,000	12	16	127
256	80	Unlimited	Unlimited	720	2,000	Unlimited	Unlimited	16,000	128
256	4	4,194,304	Unlimited	12	8	Unlimited	12	1,000	128
■	❑	■	❑	■	■	❑	❑	■	■
❑	❑	■	❑	■	■	■	■	❑	■
❑	❑	■	❑	❑	❑	■	■	■	■
❑	❑	■	❑	■	❑	❑	■	❑	■
❑	❑	■	❑	❑	❑	❑	❑	■	❑
❑	❑	❑	❑	❑	❑	❑	❑	■	■
■	■	■	■	■	■	■	■	■	■
❑	❑	■	■	❑	■	■	■	■	❑
❑	❑	■	■	N/A	N/A	■	❑	N/A	■
❑	❑	■	❑	N/A	N/A	❑	❑	N/A	■
■	❑	■	■	❑	■	■	■	■	❑
❑	N/A	■	❑	N/A	❑	■	❑	■	N/A
■	❑	■	■	❑	❑	■	■	■	■
❑	N/A	■	❑	N/A	N/A	■	❑	■	■
■	■	■	❑	■	■	❑	■	■	■
■	❑	■	■	■	❑	❑	■	■	■
■	❑	■	■	■	❑	❑	■	❑	■
■	❑	■	■	■	❑	❑	■	■	■
■	❑	■	❑	■	❑	❑	■	■	■
■	■	■	■	■	■	❑	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	❑	■	■	■	■	■	■
■	❑	■	■	■	■	❑	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	❑	■	❑	❑	■	❑	■	❑	■
■	■	■	■	■	❑	■	■	■	■
11	16	16	8	8	15	32	32	64	22
❑	❑	■	■	■	❑	❑	■	■	❑

CONTINUES



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CIRCLE 348 ON READER SERVICE CARD

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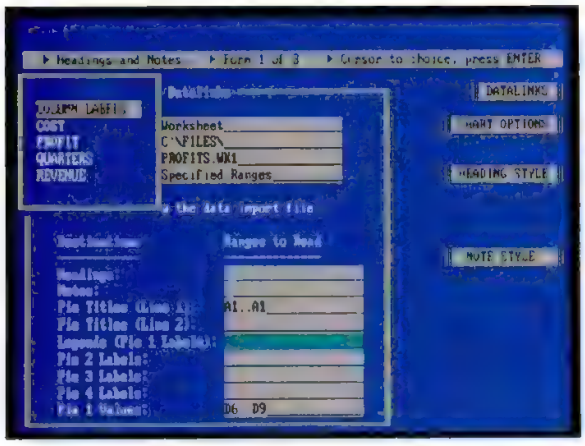
LOTUS DEVELOPMENT CORP.

Freelance Graphics for DOS

by Rock Miller

Like an aging movie star, Lotus Development Corp.'s $495 *Freelance Graphics for DOS* has had a facelift to renew its faded charms. The results are outwardly impressive, yet underneath, it's still the same old *Freelance*—both for good and for bad.

The *Freelance* aficionado will be pleased to find that the program retains the characteristics that once made it the most powerful, if not the simplest, of business graphics programs. It offers the same wide array of good-looking data, word, and table charts, the same variety of style options (though still no exploded 3-D pie charts), and the same flexible disk-based data linking. It uses the same hybrid character-graphics interface, with the same table-based screenshow and presentation manager.



Data linking is one of *Freelance for DOS*'s perennial strengths. This latest version of the program retains its flexible disk-based data-linking scheme.

Above all, *Freelance* is distinguished by its ability to exploit the capabilities of your high-resolution output devices. Its efficient drivers give you detailed control over color, font, page, and line-width specifications. The drawing screen is scaled to the dimensions of the output page (and the image is now rescaled automatically, though not always reliably, when you switch devices). The ultimate success of this approach is apparent in the results: Our test slides, which were produced using the Autographix slide driver, were of excellent quality, with vivid colors and sharp, well-rendered fonts.

Release 4.0, moreover, is chock-full of improvements, some of them long overdue. It fully supports a mouse, and orthodox yet easy-to-use pull-down menus have replaced the distracting moving-bar cursor of old. Furthermore, you can resize and move objects directly using handles, and you can change object attributes by clicking on elements in the status panel—a huge timesaver.

Most importantly, your data and word charts are now objects that can be customized, resized, and relinked from disk as often as you like. You can place multiple chart objects anywhere on the image page, and you can double-click on a chart to open up its form for modifications. It's hard to overstate the benefits of this approach: You can now add annotations to your chart and be secure in the knowledge that you can change any aspect of it later without wiping out your work. There's even a utility that lets you print entire sets of charts with new data from the DOS prompt, *à la* Lotus's *Graphwriter*.

Lotus's Freelance Graphics for DOS doesn't have an integrated outliner, but it does supply a scaled-down memory-resident version of Symantec's *Grandview* to help speed up the creation of word charts. This easy-to-use program offers a spell-checker and a good (though not comprehensive) set of style options. It works surprisingly well for an add-on. You can quickly pop it up to make changes and then regenerate your word charts as you save the outline. Doing this causes you to lose any changes or additions you've made to the individual slides, however.

NOT YET PERFECT

As far-reaching as these improvements are, they do not go nearly far enough. The program still suffers from a weak color-handling scheme, for instance, which gives you just one 12-color palette per slide. It still does not support gradient fills, except as special backgrounds applied by a slide driver, and its newly added support for scalable outline fonts is a grievous disappointment.

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

COLOR OPTIONS	
Number of preselected color palettes	
User-definable color palettes	
User can apply global color scheme	
Number of colors in working palette	
Maximum number of colors per chart	
Gradient fills:	
Horizontal and vertical	
Angled	
Radial	
User can apply gradient fills to slide backgrounds	
Visible on-screen	
User can specify fills for film recorder	
User can apply fills to objects	
ANNOTATION FEATURES	
Text annotations	
Word-wrap box	
Shadowed box	
Drawing tools:	
Line	
Polyline	
Box	
Rounded box	
Arc	
Circle and ellipse	
Spline curve	
Bezier curve	
Freehand curve	
Line styles:	
Number of line widths	
Number of line-end styles	
Number of arrowhead styles	
OBJECT MANIPULATION TOOLS	
Align to baseline	
Align to object	
Cut, copy, and paste objects	
Duplicate objects	
Flip and mirror objects	
Layers	
Group and ungroup objects	
Move objects to front or back	
Resize objects	
Rotate objects	
WORKSPACE CONTROL TOOLS	
Pan	
Zoom	
Fixed increments	
Incremental (marquee box)	
Manual redraw	
Interruptible redraw	
Keystroke macros	
Macro script language	

N/A—Not applicable: The product does not have this featur

Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
55	1	9	23	4	6	18	1	32	5,000
■	■	■	■	■	■	■	■	■	■
■	■	❑	■	■	■	■	■	■	■
200	256	16.7 million	16.7 million	64	14	256	77	64	256
16.7 million	256	16.7 million	16.7 million	252	12	256	16.7 million	256	256
■	■	■	■	■	■	■	■	■	■
■	❑	■	■	❑	❑	■	■	■	■
■	❑	■	■	❑	❑	■	■	❑	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	❑	■	■	■	■
■	❑	❑	■	■	■	❑	❑	■	❑
❑	❑	■	■	■	❑	■	❑	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	❑	❑	■	■	■	■
■	❑	■	❑	■	❑	❑	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	❑	■	■	■	■	❑
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	❑	❑	■	■	■	■
■	■	■	■	■	■	■	■	■	❑
■	■	■	■	■	■	■	■	■	■
❑	❑	■	■	❑	■	■	❑	■	❑
❑	❑	■	■	❑	❑	■	■	■	❑
■	■	■	❑	■	■	❑	■	■	❑
User-defined	5	User-defined	User-defined	8	5	8	User-defined	User-defined	3
5	5	8	8	1	2	10	8	3	3
3	9	2	6	1	1	1	6	1	3
❑	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	❑
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	❑	■	■	■	■	■	■	■	❑
■	■	■	■	■	❑	■	■	■	❑
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■ (90 degrees)	❑	■	■	■	■	■	■	■	❑
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■	■	■	■	■	■	■	■	■	■
■	■	❑	❑	■	■	■	❑	■	■
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❑	■	❑	■	■	■	■	■	■	❑
■	■	■	❑	❑	■	■	❑	■	❑
❑	❑	■	❑	■	❑	■	❑	■	■
❑	❑	❑	❑	❑	❑	■	❑	■	❑

CONTINUES

Release 4.0 does include Bitstream Dutch and Swiss outline fonts and a separate utility for converting Speedo fonts for use with *Freelance*, but unfortunately, these attractive fonts are available only on the screen and with raster printers (those that have no vector drawing commands in their printer language). If you output to a LaserJet, a PostScript device or a film recorder, you'll find that you *must* use one of the fonts built into those devices. The outline fonts merely simulate these printer fonts on-screen.

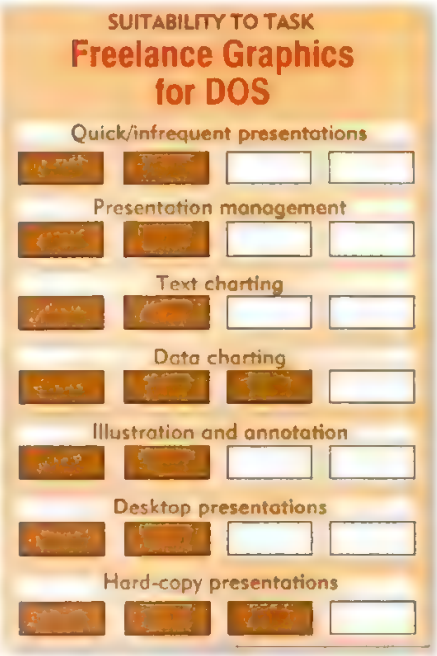
The outline fonts do look closer to your final output than the stroke fonts of old (albeit at a considerable penalty in performance), and all line breaks are shown correctly on-screen. Still, it's a far cry from the true WYSIWYG screen and printer fonts offered in any Windows program through *Adobe Type Manager* or its equivalent.

ICONLESS INTERFACE

Though Lotus engineers have improved the interface a great deal, *Freelance Graphics for DOS* is still not easy to use. The drawing and selection tools, for instance, are quite complete, but since there is no icon toolbar, every operation requires a tedious multilevel menu pick. The complexity of the formatting and style options are a significant barrier to the casual user. Many chart settings, in particular, must be set at arms length through an interminable series of multipage, multilayered forms.

***Freelance Graphics for DOS*, Release 4.0**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500.
List Price: $495.
Requires: 640K RAM, 5.3MB hard disk space, EGA graphics adapter, DOS 3.0 or later. Mouse recommended.
In Short: Decidedly improved over older versions, yet hobbled by important limitations, *Freelance Graphics for DOS* has reached the end of its useful life despite its considerable strengths. Confirmed *Freelance* users should upgrade, but new users contemplating a first-time purchase would do better elsewhere.

CIRCLE 461 ON READER SERVICE CARD



Though the Portfolio presentation manager now supports a backdrop file, which you see on-screen while creating your presentation, the program lacks global stylesheets or master pages, making graphics consistency hard to accomplish. If you set the chart style options properly at the start, and keep a few other design standards in your head, you can achieve nicely coordinated results. But changing any style element afterwards requires a grand tour through all the affected slides, and fine-tuning requires lots of tedious switching between form and image.

Text and image handling are also weak spots. Word-wrapping is supported only in text charts; text labels must still be placed line by line, though special alignment tools facilitate initial text entry. File options are also rather skimpy: You can import graphics only in Lotus .PIC, CGM, and TIFF formats (the latter only in its monochrome variant, which can't be used on slides). The included clip art is limited in range and mediocre in quality, though better images are available from Lotus at extra cost.

Finally, though the program now demands less memory, it can still be quite slow. Turning on outline fonts causes the entire image to be redrawn twice (leisurely) and incorporating a complex CGM image (such as the United States map in our test presentation) causes every object selection, no matter how minor, to be

SUMMARY OF FEATURES

Products listed in alphabetical order

PC—Editors' Choice
■—Yes ❑—No

GRAPHICS	
Clip art:	
Format	
Number of images	
Images or sampler supplier	
Extra clip art at additional cost	
Graphics file import/export formats:	
.BMP	
CGM	
Harvard Graphics	
Freelance Graphics	
.DXF	
EPS (.AI format)	
EPS	
.GEM (vector)	
HPGL	
.IMG	
.PIC	
.PCX	
.TGA	
TIFF	
.WMF	
.WPG	
PRESENTATION MANAGEMENT	
Common background	
Multiple backgrounds per presentation	
Can suppress background for slides	
Contains slide templates	
User-definable templates	
Multiple templates per presentation	
Can use templates from existing presentations	
Presentation organization:	
Presentation file	
Title sorter	
Slide sorter	
Cuts and pastes slides to Clipboard	
Outliner	
Speakers' notes	
Handouts	
Imports external outlines	
ASCII (tab-delimited)	
Grandview	
Microsoft Word	
Microsoft Word for Windows	
Desktop presentation:	
Screen shows	
Transition effects	
Number of transition effects	
Overlay images	

N/A—Not applicable: The product does not have this feature

Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
CGM	Proprietary	Micrografix.DRW	CGM	CGM	Freelance .DRW	.SYM	.GS1	.SY3	.WMF
100	60	2,200	200	400	1,000	500	520	500	400
IslandView/ MGI	IslandView/ MGI, Presentation Graphics Group	Micrografx	IslandView/ MGI	Proprietary	Lotus Development Corp.	Lotus Development Corp.	Chartersoft Corp.	Software Publishing Corp.	Genigraphics
■	■	■	■	❑	■	■	❑	■	❑
■/❑	❑/❑	❑/❑	■/❑	❑/❑	❑/❑	■/❑	■/❑	❑/❑	■/❑
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❑/❑	❑/❑	■/■	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/■	❑/❑
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■	■	■	❑	■	■	■	■	■	■
■	■	❑	■	■	❑	■	❑	❑	■
■	■	■	■	■	❑	■	■	❑	■
■	■	❑	■	❑	■	■	❑	❑	❑
■	■	■	■	■	❑	■	❑	■	■
■	■	■	■	■	❑	■	❑	❑	■
■	■	❑	■	❑	■	■	❑	■	■
■	■	N/A	■	N/A	■	■	N/A	❑	■
❑	❑	N/A	❑	N/A	■	❑	N/A	■	❑
■	❑	N/A	❑	N/A	❑	❑	N/A	❑	❑
■	❑	N/A	❑	N/A	❑	❑	N/A	❑	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	❑	■	■	■	■	❑
15	14	17	14	N/A	14	13	28	9	N/A
❑	■	■	■	N/A	❑	❑	■	■	N/A

CONTINUES

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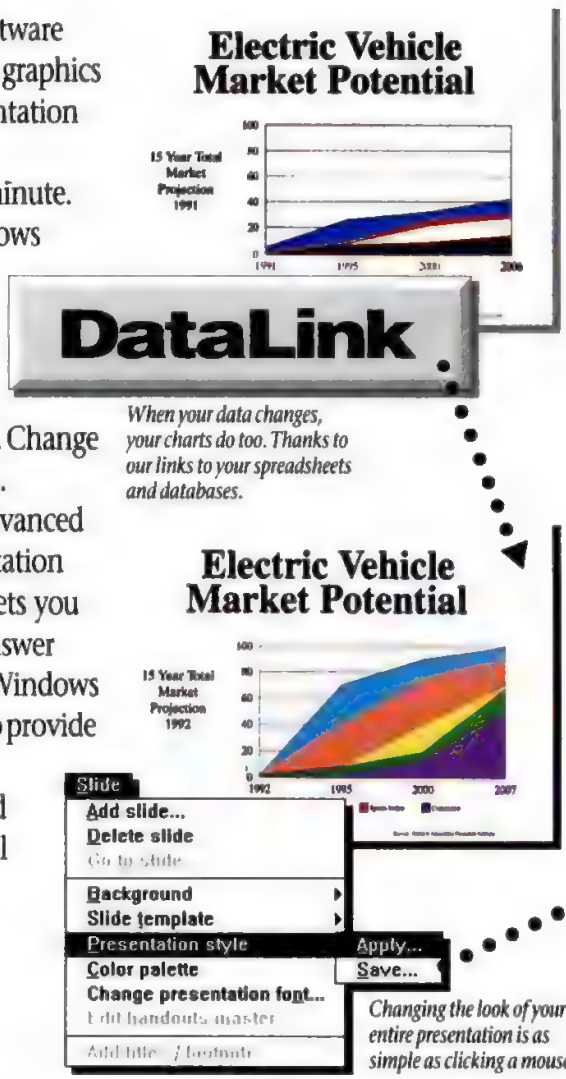

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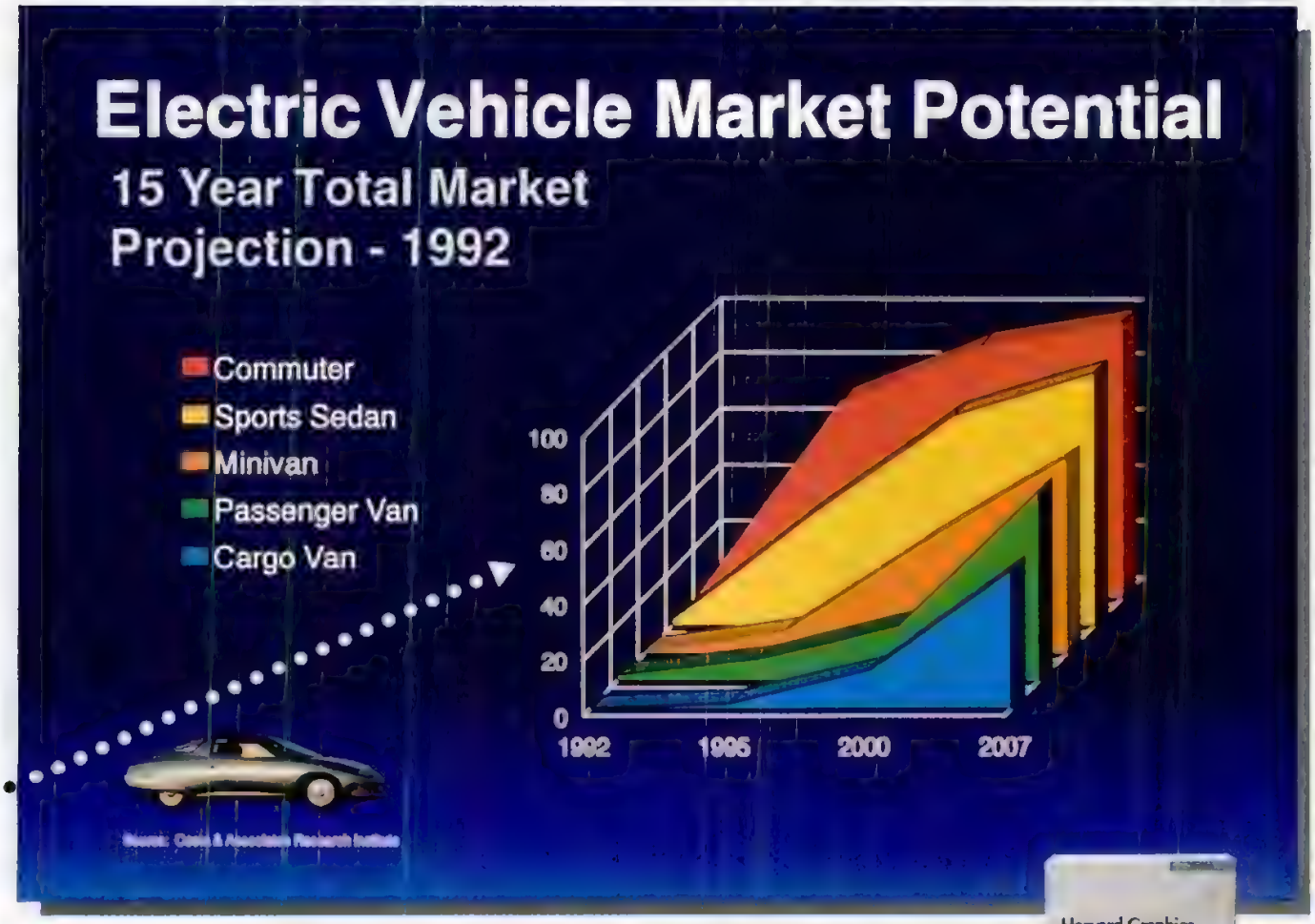
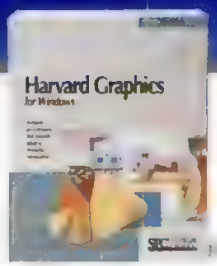


With 54 presentation styles to choose from and data links to keep you up-to-date, everything will look professional. And you will too.



Harvard Graphics for Windows demo disk.

SPC SOFTWARE PUBLISHING CORPORATION

Excel is a registered trademark and Windows is a trademark of Microsoft Corporation. Lotus 1-2-3 is a registered trademark of Lotus Development Corporation.

preceded by an excruciating pause. Though you can stop redraws by pressing Esc, the program's inefficiency can be very frustrating in detailed work.

Even with its recent renovations, *Freelance Graphics for DOS* looks dated next to its superb Windows-based cousin and the more thoroughly overhauled *Harvard Graphics*. Existing *Freelance* users should upgrade to Release 4.0, but until the program's design is fundamentally modernized, other users, especially beginners, will find more satisfactory choices elsewhere.

LOTUS DEVELOPMENT CORP.

Freelance Graphics for Windows

by Ted Stevenson

Lotus Development Corp.'s *Freelance Graphics for Windows* isn't the presentation package for everybody. But it makes a strong bid to be the package of choice for every presentation maker whose job title is more akin to Manager than to Art Director. This $495 object-oriented Microsoft Windows application has been designed from the ground up to produce slick presentations quickly, with a minimum of design expertise on the part of the user. And it delivers the goods.

NOT JUST ANOTHER PRETTY INTERFACE

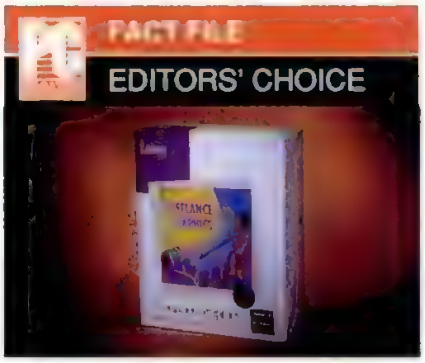
Of the many ingenious ease-of-use features built into *Freelance/Win*, perhaps the most significant are the 60 SmartMaster slide-template sets, similar to *Aldus Persuasion*'s AutoTemplates. Each SmartMaster comprises eight graphically coordinated page designs bearing preformatted placeholders (placement boxes) for text, charts, and graphics. The title slide, for example, has placeholders for a main title, a subtitle, and an optional graphics logo.

Adding text to a slide is as simple as clicking on the text prompt ("Click here to type title," is a typical prompt) and then entering text. There's absolutely no guesswork or learning involved. A miniature word processing screen—complete with ruler line, adjustable margins and indents, and fully automatic word-wrap—pops up to facilitate the process. Text attributes such as typeface, type size, and color are part of the SmartMaster design, but you can easily alter them if you so choose.

For a package as powerful as *Freelance/Win*, the interface is surprisingly simple. Menus are compact, groupings logical, and layering kept to a minimum. But Lotus has made menu navigation more or less optional: Carrying out an idea first developed in *1-2-3 for Windows* and *Ami Pro*, *Freelance/Win* provides a customizable palette of dedicated function buttons called SmartIcons. Click the SmartIcon with the image of joined jigsaw-puzzle pieces and you have "grouped" selected graphics objects; click the button with the separated puzzle pieces and you have "ungrouped" the objects. Somewhere on the Windows screen there's a one-click button for most operations.

3 WAYS OF LOOKING AT A PRESENTATION

The components of a *Freelance/Win* presentation can be created in any order and rearranged almost effortlessly. Many users will choose to work directly in the full WYSIWYG current-page view. Those who prefer to create, edit, and refine their text elements independent of visuals can work in the *outliner*. (Lotus has made a nice start on this module, which mimics a



***Freelance Graphics for Windows*, Release 1.0**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500.
List Price: $495.
Requires: 2MB RAM, 10MB hard disk space, EGA graphics adapter, mouse, DOS 3.0 or later, Microsoft Windows 3.0 or later.
In Short: *Freelance Graphics for Windows*: the time-pressed presenter's presentation package par excellence. *Freelance/Win* makes it quick and fun to create clean, elegant presentations with a distinctive designer look. A generous selection of ready-made master slide sets, complete with templates for many standard word and data chart layouts, speeds work and ensures consistent results.

CIRCLE 462 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

PRESENTATION MANAGEMENT (continued)	
Standalone runtime utility	
Sound-board support	
Hyperlinks	
VideoShow support	
Animation	
OUTPUT OPTIONS	
Print single slide	
Maximum number of slides per page	
Print entire presentation	
Print to screen (preview)	
Print to file	
Multiple-copy output	
Background printing	
Draft mode (low-resolution)	
User can turn off background for printing	
Colors convert to gray scales	
Colors convert to pattern fills	
Invert text and background colors	
Separate monochrome color scheme	
Monochrome output devices:	
Canon BubbleJet series	
Epson 9-pin printers	
Epson 24-pin printers	
HP DeskJet series	
HP LaserJet series	
IBM Proprinter	
PostScript printers	
Color output devices:	
Color PostScript printers	
Film recorders	
HP PaintJet series	
HP plotters	
SCODL-compatible devices	
Custom slide service link	
Service bureau	
Communications software included	
SCREEN DISPLAY	
Video drivers:	
Hercules	
EGA	
VGA	
SVGA (800 by 600)	
SVGA (1,024 by 768)	
8514/A	
TIGA	
XGA	
Maximum number of on-screen colors:	
Undithered	
With dithering	
HELP	
Tutorial manual	
Tutorial videotape	
On-line tutorial	
On-line help	
Sample files	

N/A—Not applicable: The product does not have this feature

Aldus Persuasion	CA-Cricket Presents	Charisma	Claris Hollywood	Express Presenter	Freelance Graphics for DOS	Freelance Graphics for Windows	GraphShow	Harvard Graphics	Microsoft PowerPoint for Windows
❑	❑	❑	■	❑	■	■	❑	■	❑
❑	❑	❑	■	❑	■	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑	❑	❑	■	❑
❑	❑	■	❑	❑	■	❑	❑	■	❑
❑	❑	❑	❑	❑	❑	❑	❑	■	❑
■	■	■	■	■	■	■	■	■	■
Unlimited	6	30	6	3	1	6	Unlimited	3	6
■	■	■	■	■	■	■	■	■	■
❑	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	❑	■	❑	❑	■	■	■	■
■	■	■	■	■	■	■	❑	■	■
■	■	❑	❑	■	■	❑	■	■	❑
■	❑	■	❑	■	■	❑	■	■	■
❑	❑	❑	■	■	■	■	■	■	❑
■	❑	■	❑	■	❑	❑	■	■	■
■	■	❑	■	■	❑	■	■	■	■
■	Windows-dependent ❑	■	■	❑	❑	■	■	■	■
■	Windows-dependent ■	■	■	■	■	■	■	■	■
■	Windows-dependent ■	■	■	■	■	■	■	■	■
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❑	❑	❑	■	❑	■	❑	■	❑	❑
■	■	■	■	■	■	■	❑	■	■
Autographix	Autographix	Slidemasters	MagiCorp	MagiCorp	Autographix	Autographix	N/A	Autographix	Genigraphics
■	■	■	■	■	■	■	N/A	■	■
■	■	■	■	■	■	■	❑	■	❑
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	❑	■	■	❑	■
■	■	■	■	■	❑	■	■	❑	■
■	■	■	■	❑	❑	■	■	❑	■
■	■	■	■	❑	❑	■	■	❑	■
■	■	■	■	❑	❑	■	■	❑	■
256	16	16.7 million	256	252	12	256	256	16	256
256	256	N/A	256	252	72	256	32,000	256	16.7 million
■	■	■	■	■	■	■	■	■	■
❑	❑	■	❑	❑	❑	❑	❑	❑	❑
❑	❑	■	❑	❑	❑	■	■	■	❑
■	■	■	■	■	■	■	❑	■	■
■	■	■	■	■	■	■	■	■	■

ENDS

HOW WE TESTED AND WHAT WE FOUND

Our testing was composed of two discrete parts. The first section was designed to provide a "quick presentations" Suitability to Task rating where each reviewer had to create a presentation containing six slides as quickly as possible, using all of the package's convenience features, such as sample templates and tutorials. (An example of the presentation used for this purpose appears in the May 14, 1991, issue of *PC Magazine*.) To compensate for the different approaches that authors take when creating presentations, we had each reviewer create a quick presentation for a second package, in addition to the one he or she was assigned to review.

For the remaining—and most extensive—testing, our reviewers created a 12-slide presentation designed to test the software's general ease of use, as well as its flexibility in handling specific tasks. When finished, they created speakers' notes and handouts, then printed them on an HP LaserJet III and a QMS ColorScript 100 printer. The presentations were imaged as 35-mm. slides by a slide service bureau with a direct communications link within the package; if a link did not exist, they were imaged at a bureau recommended by the vendor.

Besides illustrating the test images, the following slides provide examples of our output from the packages.

MASTER PAGES

This slide tests a package's ability to create a template or master page. It consists of an imported monochrome TIFF logo, an upper-left-to-lower-right-corner gradient background of light gray to dark blue, and a simple graphics frame to define the work area, as well as type specifications for a chart title (not shown).

***Microsoft PowerPoint for Windows'* slides imaged fairly well. The only real glitch was *PowerPoint's* inability to make the logo's white background or chart legends transparent.**

TITLE PAGE

This slide tests the basic graphics- and text-handling capabilities of the product, including the ability to create a filled, shadowed rectangle and to use multiple type sizes on a single page. Importing and placing a complex graphics image—either a .WMF or a color .PCX file—test the object- and color-mapping capabilities of the software.

Management Graphics of Toronto, which imaged *GraphShow's* slides, could not make the logo's white background transparent; curiously, it imaged as a solid black square.

TEXT CHARTS WITH CLIP ART

These slides test text handling, including importing an ASCII file with multilevel indents into an outliner to create four simple bullet charts with multiple typefaces. In addition, each reviewer selected one or two pieces from the clip-art library included with the packages to dress up the charts.

The slides shown here come from three different packages: *Freelance Graphics for Windows*, *Freelance Graphics for DOS*, and *CA-Cricket Presents*. *Freelance Graphics for Windows* was one of the two packages able to import and image the TIFF logo flawlessly. The background on the complex graphics image did not import transparently; however, Autographix's imaging was very good.

***Freelance Graphics for DOS* and *CA-Cricket Presents* were able to import and display the logo properly, but Autographix was incapable of imaging it from those packages; the reviewers created a simple text logo as a replacement. Neither package supported a corner-to-corner gradient in the background, so we used a top-to-bottom gradient.**

The output from *Freelance/DOS* was generally attractive, although the gradient was so subtle that we found it indistinguishable from a solid. The *CA-Cricket* slides were very well done.

In addition to testing the package's basic numeric charting capabilities, including data handling and data file importing, the following three slides test how easy it is to edit the labels and legends, as well as accurately size the entire chart. The data, which included several named ranges, was imported in either .XLS or .WK1 format and left linked to the file on-disk wherever possible.

ANNOTATED GRAPHIC

This slide tests the package's drawing and annotation features, including object grouping, placement, and coloring, as well as EPS or CGM file import (maps derived from *Micrografx U.S. Maps, Special Edition*) and free-form text annotation.

Harvard Graphics **joins the ranks of those packages unable to make the logo's white background transparent. While the slide was generally well-imaged by Autographix, its left and right margins were unusually large**

COMBINATION DATA CHARTING

This slide tests the package's ability to create a combination chart—specifically, line over bar. It also tests the ability to format the long *x*-axis labels intelligently and to format and place a legend and a caption.

SIMPLE DATA CHARTING

This slide evaluates a package's ability to create a simple 3-D pie chart with one yanked slice, a legend format, and drop-shadowed text.

TWO-COLUMN PROGRESSIVE-BUILD TEXT CHART

This slide tests the ability to create complex bullet charts: a two-column chart with custom bullets and a chart with grayed-out text from the previous slides. In some cases, the bullets were created from clip art. This is especially challenging, because not all packages directly support multicolumn charts and custom bullets, and those that support progressive builds do so only through their screen-show modules.

Aldus Persuasion was the only package besides *Freelance Graphics for Windows* that properly imported and imaged the TIFF logo. With the exception of one y-axis label that mysteriously jumped halfway off its slide, MagiCorp perfectly imaged the *Persuasion* slides.

TABLE CHARTING

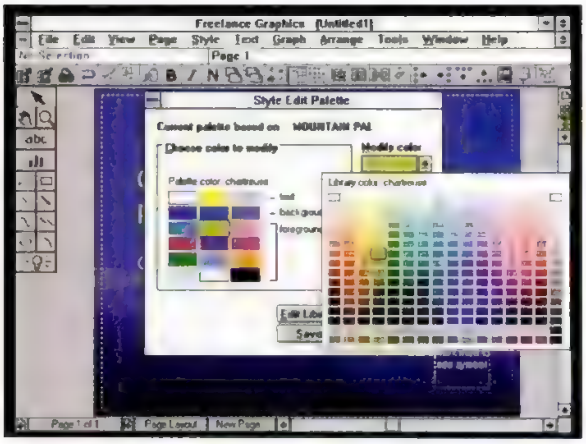
This slide tests the software's automatic table charting, with its associated text and data handling, including capabilities such as chart sizing, background transparency, variable column widths, and text alignment.

yellow legal pad, but there is room for improvement: It lacks the expand-and-collapse feature we'd expect in a word processing outliner, and it can't be used for complicated work like multicolumn charts.) A thumbnail (page-sorter) view provides an at-a-glance overview of your presentation for up to a maximum of 12 slides at once. You can instantly change slide order in either thumbnail or outline view by grabbing and dragging.

FAIRLY CUSTOMIZABLE

While not every detail of a *Freelance/Win* presentation is subject to user control, much can be changed to suit individual tastes and situations; even the SmartMasters themselves can be customized. For example, to alter the overall look of a master set, users can select a new color palette from the 18 supplied. These palettes—and the color library they are drawn from—can be customized using any of 16.8 million colors.

You can change the graphics design of SmartMaster sets, too, relocating or resizing placement boxes, modifying text attributes, adding clip art or a graphics logo—or designing an entirely new master set from the ground up, using the skeletal *Custom* set provided. After one false start, I was able to create the masters for our full test presentation in less than half an hour.



The Edit Palette dialog is typical of *Freelance Graphics for Window*'s clean, easy-to-follow menus. To alter a predefined palette, simply click to select a new color from the library of 256 colors—or create your own, using the program's custom color mixer.

The program suffers from one serious design-tool omission, however: It lacks an on-screen ruler to facilitate the precise placement of elements. The package does provide a snap-to grid and cursor coordinates, but a ruler would have been much more in keeping with *Freelance/Win*'s approach.

Freelance/Win's charting capabilities are robust, if somewhat short of comprehensive. The visual chart gallery offers nicely designed versions of the usual chart types, as well as mildly exotic variants, like text tables, line-bar charts, dual y-axis treatments, and scatter charts.

The package's data handling is better than average. For the basics, you enter numeric data on a spreadsheet-like grid; titles, legends, and labels are typed on a pop-up text-entry window. If you click the Done box, your chart is there. Data import from .WK1 files is quick and smooth. (*Freelance/Win* also supports import of ASCII and SYLK data.) Unlike most of the other packages reviewed, *Freelance/Win* offers basic linear and exponential curve fitting. Finally, the package does support dynamic data links to other Windows applications. I was able to link a *Freelance/Win* chart to a *Microsoft Excel* spreadsheet file, but the procedure was cumbersome enough to make me think twice about doing it on a regular basis.

You can annotate your charts easily enough using *Freelance/Win*'s powerful text and drawing tools. Fully formatable text labels are a snap: You simply click the text tool, draw a bounding box, and type the text. There's a full selection of easy-to-use drawing tools: line, box, polyline, polygon, circle/elipse, arc, and Bézier curves—even a dedicated arrow tool. Further, you can tweak and fine-tune many, though far from all, chart elements, such as text size and color, legend placement, and overall color scheme, to a fare-thee-well.

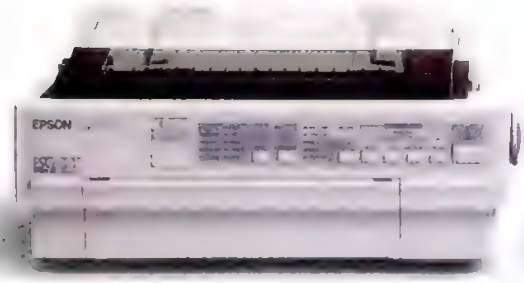
NOBODY'S PERFECT . . .

Freelance Graphics for Windows makes such good use of color, including a nice variety of gradient backgrounds and fills, that it cries out for top-quality reproduction. Autographix, one of three slide output services that *Freelance/Win* can link to, produced excellent slides from our presentation files. The color was brilliant; fonts were crisp and true. The problem? Overmasking. That is, less of the image showed through the slide mounts than was indicated on-screen by Autographix's "show printable area" mask. This essentially sabotaged our basic presentation design. A similar problem occurred when outputting to a color PostScript printer. In this case, the printable area mask was reversed left-to-right, resulting in significant parts of the image being cut off altogether. New drivers from Autographix promise to remedy these faults.

On a more positive note, black-and-white laser output was quite good, partly thanks to the two (one light, one dark) gray-scale palettes provided. They handle well the tricky job of mapping colors for monochrome rendition. For those who prefer to deliver their presentations from the PC screen, *Freelance/Win*'s screen-show feature, while not the most sophisticated in the world, will prove effective and gratifyingly simple to use.

Despite the problems noted, *Freelance Graphics for Windows* has the look and feel of a product with staying power. Again, it doesn't strive to be all things to all people. Folks who churn out highly stylized presentations day in and day out may want greater control over fine details, for example. But what it does, for the most part it does superbly well. It certainly succeeds in delivering what most business people need in an easy-to-use graphical presentation package.

Presenting The Next Page In Printer History. From The Company That Printed The First.



Funny how history has a way of repeating itself. Year after year—actually for the past 25—Epson® has been the leader in dot matrix printing technology.

Introducing six reasons why that leadership is sure to continue: the letter-quality Epson LQ-570, LQ-870, LQ-1070, LQ-1170, ActionPrinter™ 5000 and ActionPrinter 5500.

More Paths To Success.

For sheer paper handling flexibility, no other printer—dot matrix, ink jet or laser—handles quite as well as these.

Case in point: the versatile LQ-870 and wide-carriage LQ-1170.

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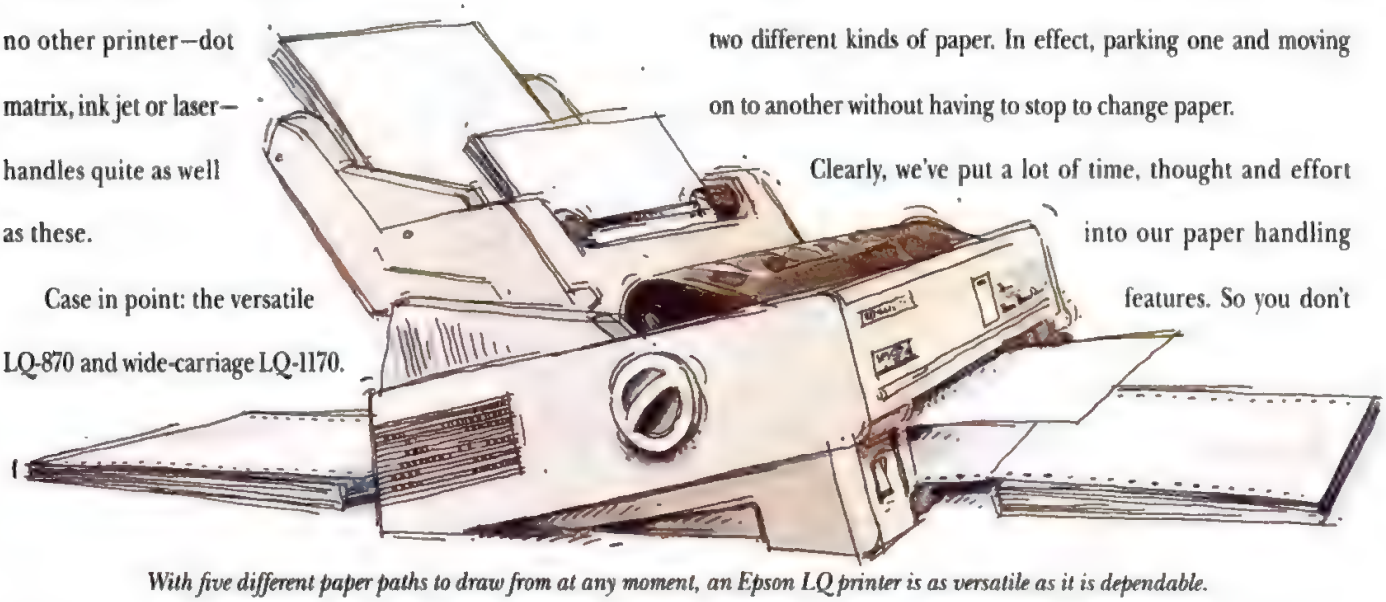
Clearly, we've put a lot of time, thought and effort into our paper handling features. So you don't



With five different paper paths to draw from at any moment, an Epson LQ printer is as versatile as it is dependable.

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have to put much time, thought or effort into using them.

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Simply put, type sizes are no longer as limited. So now you can do things with a 24-pin printer that before could only be done with a laser. And you don't have to give up one bit of paper handling flexibility to do it.

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It includes an enhanced Windows™ driver, exclusive to Epson. When you print from any program running in Windows, you'll get superior output quality and faster throughput speeds.

SCALABLE FONTS

With a new Epson LQ printer, you can print a variety of type in a variety of sizes, up to 32 point.

But don't just take our word for it. Take a look at the quality of our graphics instead.

Built For The Long Run.

Epson printers aren't only designed with more firsts, they're designed to last. Each is backed by a generous 2-year limited warranty. As well as a helpful toll-free 800 number to provide you with dependable, expert assistance.

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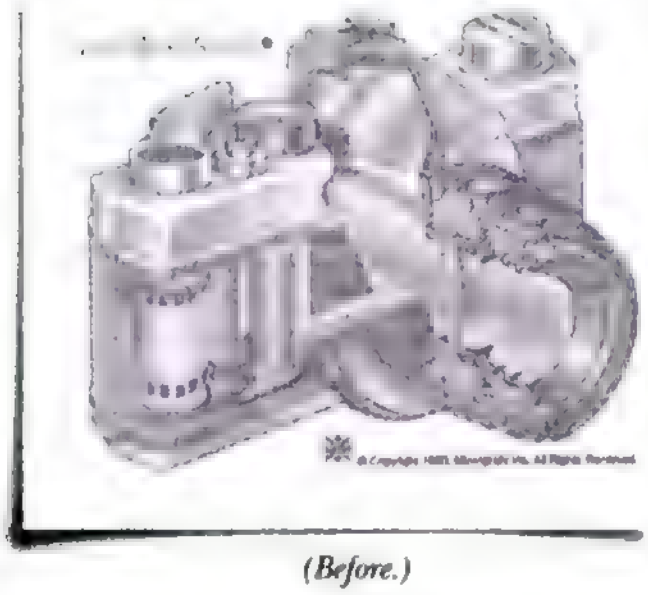
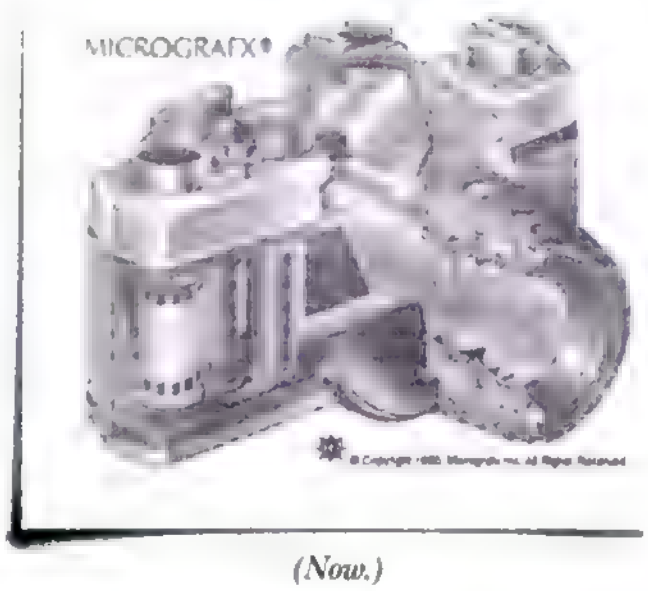
To see the latest printer innovations firsthand, visit your nearby Epson dealer, or call 800-289-3776. And see why, after more than 25 years, Epson is still the first name in dot matrix printing.



(Before.)



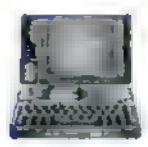
(Now.)

Epson's enhanced Windows driver improves not only the look of your text and graphics, but the speed at which they print.

EPSON

Desktops

Dot Matrix



Notebooks

Lasers

Servers

MICROGRAFX INC.

Charisma

by Carol Ellison

Novices and power users will find much to appreciate about *Charisma;* it's the everyday user who may be disappointed. This robust and flexible $495 Microsoft Windows–based presentation program from Micrografx offers a great deal of customizability and many of the drawing tools found in the company's high-end drawing program, *Designer*. It's easy to get up and running with *Charisma*, but the program lacks some important features for standard presentation creators, like a slide sorter and outliner.

To create speaker's notes or handouts with *Charisma*, you add a text page next to the desired slide and print them together using the program's Print View function.

The program features a WYSIWYG work area in the form of a single, large virtual page with lines that divide it into equal-size boxes that represent the print area as determined by your current output device—in essence, a multipage layout view in which you create, view, and rearrange your slides. *Charisma*'s interface is standard fare for any Windows user: a toolbar to the left and a string of pull-down menus at the top of the screen. You can customize the various templates (which you choose from the toolbar) from the pull-down View menu. It's here that you set the screen color, background, pattern, text styles, and bullets. Unlike programs such as *Microsoft PowerPoint for Windows* or *Freelance Graphics for Windows*, these characteristics are not combined in master templates; *Charisma* requires you to make numerous choices if you're not happy with its defaults. *Charisma*'s default text color is basic black but you can custom spec word chart templates to combine a variety of fonts, colors, and bullets in a single template. You can even override these specs to change a letter or group of letters in a line of text.

The program speeds slide creation with templates both for word and for data charts. Through these templates, you can universally assign colors and sizes to text and objects. This eases the task of creating presentations, but the program lacks a number of universal mechanisms that would make the process even easier.

There is, for instance, no spell-checker. There is also no outliner in which you can globally edit and organize a presentation. But you can import text through the Windows Clipboard or type it into a Word Chart template or directly onto a slide using the Text tool.

PAGES AND PAGES

Beginners can come up to speed in a relatively short time, thanks to *Charisma*'s two manuals: a Learning Guide and a Reference Guide. The Learning Guide is filled with tutorials and a pictorial summary of the program's clip-art files. A quick tour through this manual is all you need to learn enough about the product and its tools to assemble a quick-and-dirty presentation. We assembled our quick presentation in well under the four hour time limit, after reading the Learning Guide.

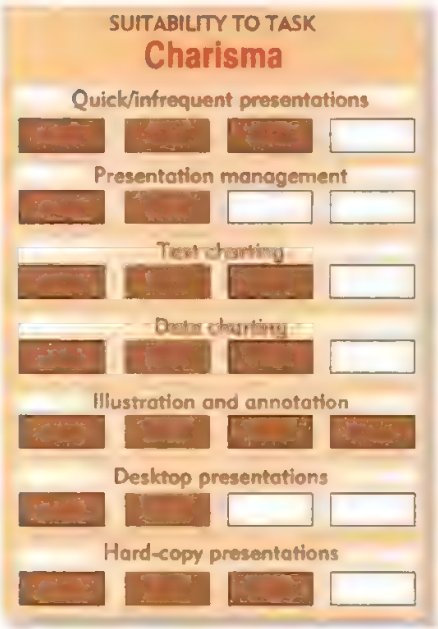
The Reference Guide offers good explanations of the more arcane features in the program. But, at times, it skimps on details needed to use those features. For instance, we had to call technical support to find out why the results of formulas in an imported .WK1 file did not appear in *Charisma*'s worksheet. The answer was simple: You must convert formulas to values within *Lotus 1-2-3* before importing the file. But the Reference Guide did not explain this. It also neglected to point out that while a histogram is offered as a chart type among data chart templates, the program itself will not calculate the histogram from data in a worksheet. That must be done in the spreadsheet. Nevertheless, *Charisma* does perform a number of other calculations, including linear, exponential, and logarithmic regression analysis within its charting functions. Charisma does offer the most extensive array of chart tools, although your ability to edit the chart elements is limited on occasion.

FULL TOOLBOX

One of *Charisma*'s chief attractions is its wide selection of *Designer*-like drawing tools. It features a freehand drawing tool, as well as Bezier curves. Furthermore, in addition to tools, you can add frequently used items like specially mixed colors or gradients to the toolbar for easier access. And like *Designer, Charisma* employs scalable fonts that can be sized as small as one point or as large as 144 points, rotated and combined, broken apart, stretched, scaled, zoomed, or flipped.

Despite all of these tools, *Charisma* overlooks some useful, more standard effects. There's no automatic drop shadow feature, although you can duplicate the desired object or text, drag one to an offset position and shade it a different color. Nor does the program have a slide sorter. You can use its multiple-page view for this purpose, but the procedure is quite cumbersome. The images on each page must first be grouped and then shuffled from page to page until you're happy with the arrangement.

The final measure of any presentation program is the quality of its output, and in that arena *Charisma* earns its name. The program supports all Microsoft Windows



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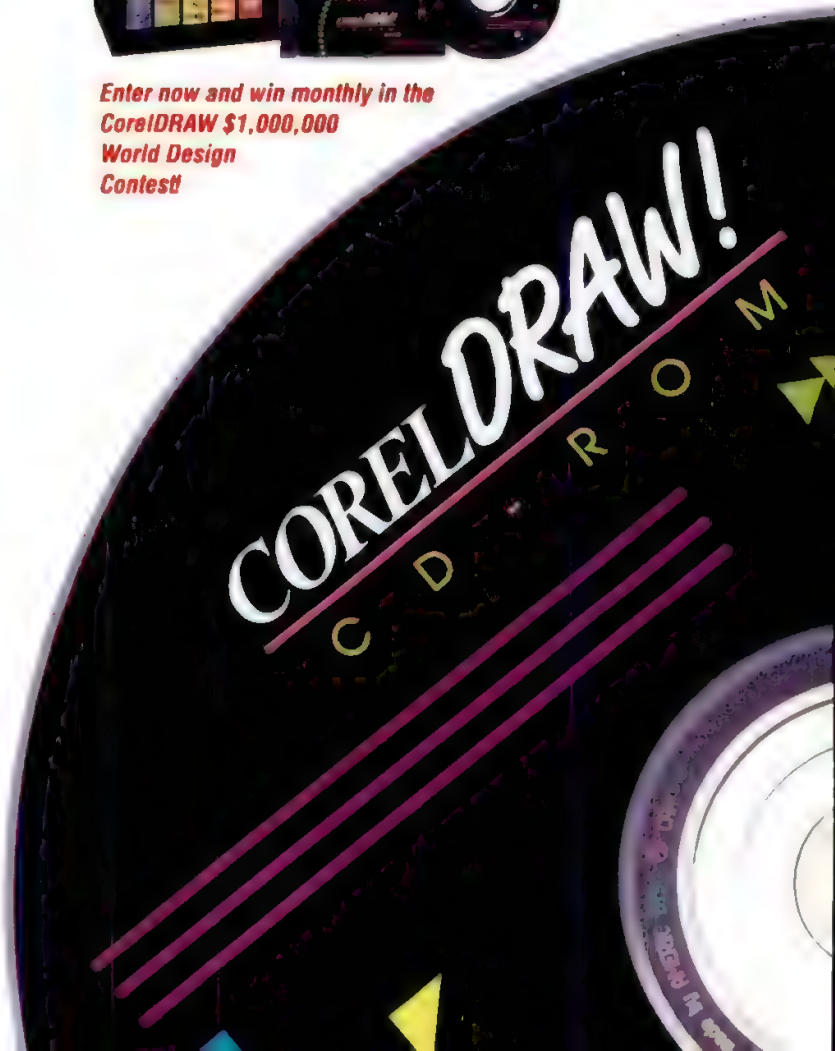

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Charisma
Micrografx Inc., 1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1769.
List Price: $495.
Requires: 1MB RAM (2MB recommended), 12MB hard disk space for clip-art library (8MB without library), EGA graphics adapter, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: Notable for its ability to produce both quick-and-dirty presentations and customized hand-drawn images, *Charisma* rewards beginners and power users while leaving those in the middle hungry for more. Its lack of an outliner, spell-checker, and ready-made presentation templates means users will have to work harder with *Charisma* than with some other presentation graphics packages.

CIRCLE 469 ON READER SERVICE CARD

printer drivers and features enhanced drivers for plotters, PostScript printers (both color and black and white), and the Hewlett-Packard PaintJet. The program competently handles translations to gray scale when the images are printed on a LaserJet, and it features a batch printing utility which makes printing multiple images for a presentation a one-step process. There is a hitch, though. While *Charisma* automatically resets the size of your working page area on-screen when you change printing devices, it doesn't do the same for the text and clip art in your images. You'll have to resize them manually and reposition them on the new page for the output to turn out right.

In addition to its hardcopy capabilities, *Charisma* includes a screen-show facility in which you can specify a variety of transition effects between images, as well as a built-in communications module, TeleGrafx, for sending slide images directly to the SlideMasters or MagiCorp service bureaus. The TeleGrafx program is almost fully automatic; it prompts users for the names of files being sent, the number of copies, the user name, address, and credit card number and will store the information on disk along with the images or transmit them to a service bureau via a modem connection.

Charisma offers all of the tools you need in a good presentation graphics program. But the package strives so hard to offer the most choices for your presentation that they've left out a few vital things that could make the creation process a lot easier.

MICROSOFT CORP.

Microsoft PowerPoint for Windows

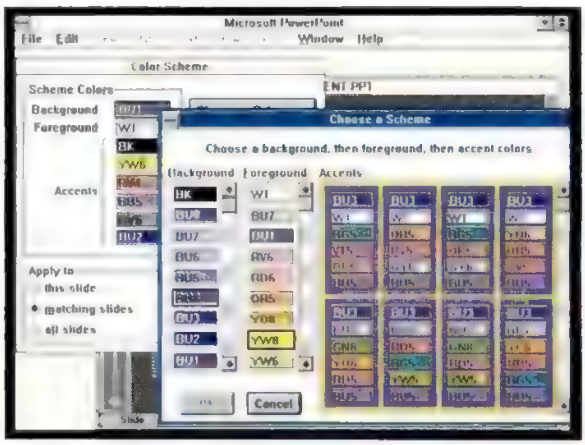
by Gayle C. Ehrenman

How time flies! Less than a year ago, *Microsoft PowerPoint for Windows* was the flashiest, most capable rookie in the presentation graphics field. Now, this past Editors' Choice seems like a veteran who still has the skills, but neither the flash nor the flesh to keep up with the latest crop of players. This $495 package can still turn out good slides—if you're willing to invest some energy—but it's changed little since the last time we reviewed it ("Presentation Graphics," May 14, 1991). Features like master slides and an object-oriented interface, which were unique then, have become commonplace. And some features, like *PowerPoint*'s transitionless screen shows, seem downright dated.

In fact, the only new feature in this version of the program is a translator module that converts *Harvard Graphics* chart files, slide shows, and templates into editable *PowerPoint* presentations and slide masters. Unfortunately, like the rest of *PowerPoint*, this module is already slightly behind the times: It doesn't work on files from Version 3.0 (the latest version of *Harvard*).

Happily, much of *PowerPoint* continues to be commendable. The object-oriented interface lets you work directly with slides on the screen; to edit an object, you simply click on it. And since it's truly a WYSIWYG display, what you see on-screen is what you'll see on the imaged slides. The interface also makes good use of its Microsoft Windows–style icons and pull-down menu command system.

PowerPoint's use of the total presentation as the organizing metaphor is still a good one. No slide is simply a slide here—it's part of a larger picture that includes automatically generated handouts and notes. And *PowerPoint* has plenty of features that make it easy to deal with the presentation as a whole—including Slide Masters, templates, coordinated color palettes and a slide sorter. The Slide Masters are presentation-specific templates that let you specify the common elements for your presentation, including text formatting, backgrounds, color palettes, and art. The package provides an array of predesigned templates you can use as master slides if you don't want to roll your own. For those who can't distinguish mauve from magenta, *PowerPoint* eases the color selection process by suggesting foreground and accent colors that coordinate with your selected background shade. And if you need to add a slide or alter the order of your presentation—even borrow a slide from another presentation—it's as easy as pointing and dragging a thumbnail from within the slide sorter.



Microsoft PowerPoint for Windows **provides over 5,000 color schemes professionally designed by the Genigraphics slide service. These schemes make creating a color-coordinated presentation as easy as selecting a background color, if you follow the program's suggestions for foreground and accent shades.**

Unfortunately, *PowerPoint*'s approach to word charting isn't very successful. There is no outliner for creating text nor are there forms to follow; in fact, *PowerPoint* doesn't really seem to consider text slides a type of chart. The intimidating hardcover manual lacks a coherent section on "How to Create Bulleted

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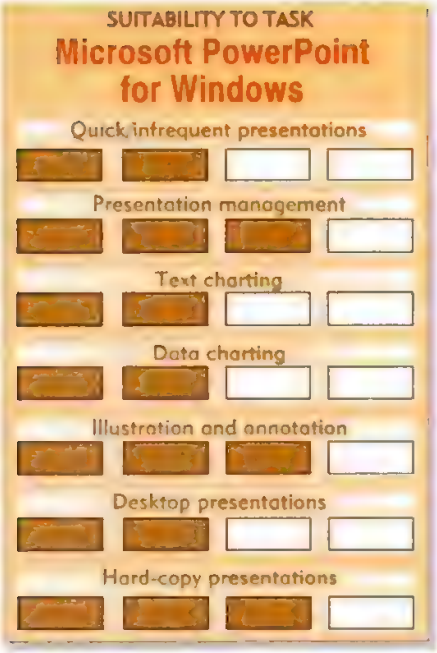


Word Charts"; instead, it scatters information on the many necessary steps piecemeal throughout the manual. Fortunately, once you find it, the information is quite useful.

To create a word chart, you draw a box on your slide with the text tool, then type in your text. After you've entered the text, you can add bullets (*PowerPoint* uses Zapf dingbats) and indents, and change text size and style via pull-down menus. Fortunately, editing text on a *PowerPoint* slide is a lot faster than creating it: You highlight the text you want changed and enter the corrections directly on the chart.

TIMEWORN AND TIRESOME

PowerPoint's rigid data charting, which is handled by the separate *PowerPoint Graph* module, is more timeworn than its word charting. You can create only the most basic chart types in a limited number of formats here. For any remotely complicated charts, you'll need to turn to *Excel*'s extensive charting capabilities, which *PowerPoint* can seamlessly access thanks to support for object linking and embedding (OLE).

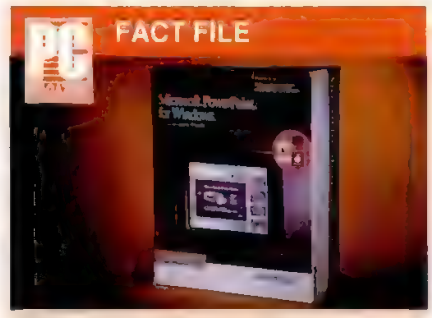
If you're not an *Excel* user you are, alas, stuck with the unpredictable *PowerPoint Graph*. Always minimal, it now looks downright dysfunctional. When you access the Insert Chart command, you're faced with two windows: a datasheet and a sample chart. The problems start with the default datasheet, which contains the data used to generate the sample bar chart. If you clear this data en masse so you can start working with a blank datasheet, you'll lose the format thumbnails for pie charts, a phenomena that *PowerPoint*'s tech support could not explain.

Another option is to import data, but this is just as time-consuming. You can't simply designate a row or column to use as an axis or label; you need to describe your data, using functions like Include, Exclude, and Series in columns and rows. If you want imported data to appear as labels, you must make sure it's in the first row or column, or it won't appear on the chart.

ATTRACTIVE OUTPUT

Despite its deficiencies, *PowerPoint* can produce attractive slides. Its custom software link with Genigraphics suffers from some minor glitches, like reporting that objects close to the frame edge are out of the frame, but overall the service is laudable. The transmission process is a relatively painless one and the slide output is well worth the effort.

Microsoft PowerPoint for Windows may be showing its age, but there's life in the old package yet. Features like slide masters and professionally designed palettes may no longer seem as revolutionary as they once did, but they still go a long way toward automating the slide creation process. This wily old veteran is badly in need of some updating, but it can still teach the rookies a thing or two about presentation management and quality output.



Microsoft PowerPoint for Windows
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080.
List Price: $495.
Requires: 2MB RAM, 8MB hard disk space, EGA graphics adapter, mouse, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: This veteran of the presentation graphics wars is no slouch at putting together a presentation. But many of the rookies have taken what *Microsoft PowerPoint for Windows* does well and gone one, or two, better. Its Slide masters and professionally designed color palettes still go a long way toward automating the slide creation process, but you'd do well to wait for a later version.

CIRCLE 464 ON READER SERVICE CARD

SOFTWARE PUBLISHING CORP.

Harvard Graphics

by Kellyn Betts

It's a tricky proposition, trying to modernize and expand a venerable old structure: Think of the outrage I.M. Pei's addition to the Louvre inspired. Last year, Software Publishing Corp.'s attempt to upgrade *Harvard Graphics*' drawing tools by adding Draw Partner met with much the same reaction.

Luckily for SPC, it's much easier for software architects to haul their unpopular attempts back to the drawing board. And for Version 3.0, the architects came through for the six-year-old, $595 presentation package. The juxtaposition of the old and new is just as jarring, but like the series of additions hidden behind the Metropolitan Museum of Art, *Harvard*'s new wing is justified by its new, easily accessible gallery of drawing functions.

The key to the success of *Harvard*'s new drawing features is their almost-seamless integration. The module looks like a drawing page with an icon-driven toolbox. Though the software remains firmly bound to DOS, this drawing page is about as graphically oriented as you can get without going GUI. (SPC *is* nearing completion of a Windows version of the program.) Accessible throughout the program via a function key, the drawing module supports the mouse as adeptly as does the rest of *Harvard*.

Besides bringing *Harvard* 3.0 a commendable range of drawing tools, the new module provides a huge array of coloring options. You can choose from 32 predefined 64-color palettes or create your own from more than 16 million color options. Version 3.0 offers two ways to create colors: by using slider bars for either Red-Green-Blue or Hue-Saturation-Values mixing. With all this color power, it's unfortunate that the program can't display more than 16 nondithered colors onscreen.

In addition to tools for drawing Bezier curves, rotating and flipping objects, and

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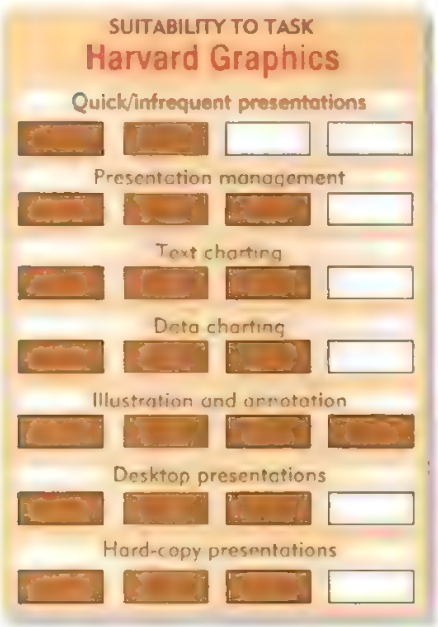
zooming in on areas, the draw module also comes with what may be the industry's best set of text-annotation tools. You have three options for determining how text will fit into a bounding box, as well as a generous number of options for formatting and enhancing its display. Alas, though Harvard now supports Bitstream Speedo fonts, the package still insists on sizing text as a percentage of screen instead of using industry-standard point sizes.

PRESENTATION ORIENTATION

In this latest incarnation, *Harvard* has done a reasonable job of embracing the presentation orientation. You still organize the presentation in a tabular, text-based form (similar to *Freelance Graphics for DOS*'s Portfolio), but even though there is no visual slide sorter, the inclusion of a "save to current presentation" option in the file save form is quite helpful. The ability to print multiple charts per page and to create speaker's notes is useful, though the implementation is simplistic. The package retains its superior screen-show–creation tools, supplementing them with added animation and object evolution functions (what many programs call morphing or tweening).

A notable new presentation-oriented tool in *Harvard* is called the canvas. This tool allows you to paint a square onto any slide background you've created. When you attach a chart to the background, the chart sticks to the canvas area as if the square you previously drew were a bounding box for the chart. It is really a logical way to incorporate the master slide concept into this package.



SAME AS IT EVER WAS

Save for a few incremental enhancements, the rest of *Harvard* is the same. Even if you're a complete *Harvard* novice, you can still create the vast majority of common charts—including multicolumn tables—rather quickly. Whether you start from the visually oriented charting gallery of 160 samples or choose a chart type by name, you're required to do little more than fill in the requisite data. With this release, you can combine as many charts as you can fit onto a single graph. Still, no matter how you enter your data, you don't get as much control over chart element placement as you can with a Windows package.

The text-charting module shows the limitations of the template-based DOS orientation, too. If *Harvard* offered the same range of typographical controls here as it offers in its Draw module, it might well be the ideal text charting package. As it stands, the text module's lack of an outliner and its rigid formatting requirements limit its utility. Sure, it can produce text charts quickly, but only those of the simplest order and design.

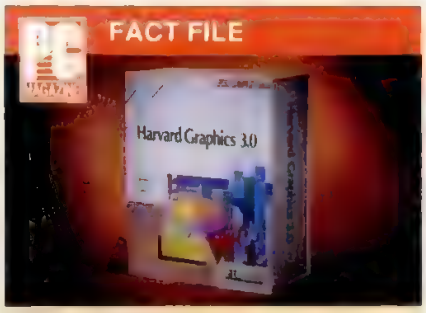
The draw module can help you overcome these DOS-based restrictions. Its grouping and ungrouping functions are especially useful for removing at least part of the charting modules' rigid control over object placement. And its ease of use and strong text-formatting options make the draw module a great alternative for creating odd-ball text charts, as well as graphics.

For embellishing your charts, *Harvard* can now import a wider range of graphic formats, including TIFF, .PCX, and *Lotus 1-2-3* and *Microsoft Excel* charts. And there's always clip art, too; the package's 500-odd images are on the simple side, but they are logically created and easily customizable. Outputting from black-and-white proofs to color laser handouts to slides is deceptively easy because the program is completely device independent (and there are no surprises thanks to a new, *Freelance*-like print preview screen). The slide service link to Autographix has been simplified so that you must do little more than fill out an order processing form. We were very pleased with the slides we created during testing.

In Version 3.0, Software Publishing has done an admirable job of melding the old and new to both capitalize on the program's existing strengths and build new ones. You're still better off going with a Windows package, but if DOS is your OS, *Harvard Graphics 3.0* is once again the presentation package to buy.

***Harvard Graphics 3.0*'s new Draw module is robust enough for you to create complex text charts. In fact, the Draw module's text-formatting options are much more flexible and extensive than those found in its text-charting module.**

FACT FILE



Harvard Graphics 3.0
Software Publishing Corp., 3165 Kifer Rd., P.O. Box 54983, Santa Clara, CA 95051; 408-986-8000.
List Price: $595.
Requires: 438K RAM, 11MB hard disk space, EGA graphics adapter, DOS 3.1 or later. Mouse recommended.
In Short: *Harvard Graphics 3.0* proves that you can still rely on a DOS-based package to produce your presentations. A well-designed and well-integrated new drawing module has given this venerable old product a new lease on life by building on its old strengths.

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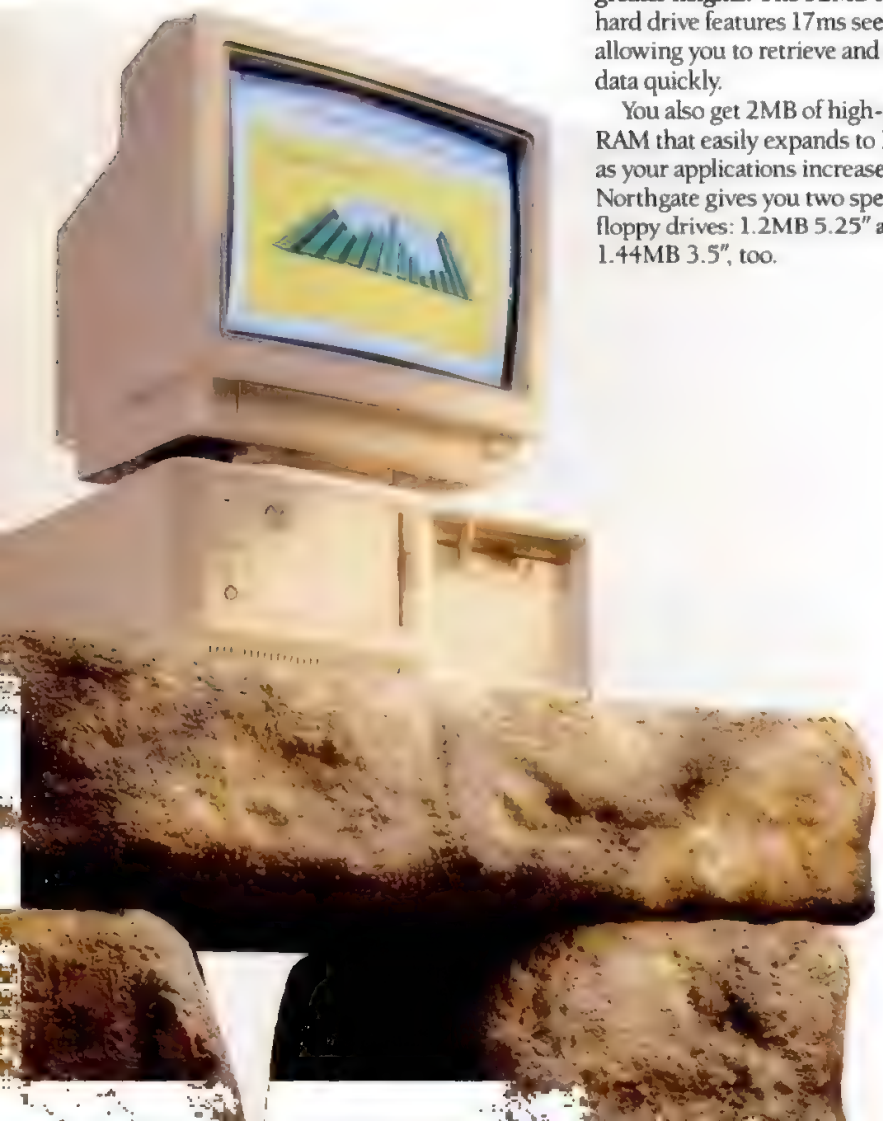

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CODE A2905

CLARIS CORP.

Claris Hollywood

by Paul Murphy

Hollywood has often been accused of emphasizing style over substance, but the same cannot be said of *Claris Hollywood*. Claris Corp.'s $499 Microsoft Windows–based presentation graphics package contains all of the tools to produce four-star slides and shows, but falls short ultimately because the producer (IBM Corp./Claris Corp.) never quite gives full control of the set to the director (the user). Despite its wealth of features, *Hollywood* is too difficult, and in many ways, too awkward to use.

The awkwardness starts with the interface. *Hollywood*, like some of the other Windows packages reviewed here, offers integrated slide, outliner and data views, but unlike the others, as you move from the outliner or data view back to the slide, *Hollywood* saves your work in a proprietary format. Tools are located in an editable icon-based toolbox. You can add or delete tools, save them in sets, and move or hide the toolboxes, but the tools are much too large on a standard VGA screen and tend to get in the way constantly. The program uses drop-down menus, but these are often oddly organized. For instance, though *Hollywood* offers templates and color schemes to automate the appearance and placement of elements on the slide, it places them in the Special menu rather than in the routine for setting up a new presentation.

Don't expect to dive into *Hollywood* without thoroughly exploring the documentation.

More than just the menu placement of the templates and color schemes is awkward. *Hollywood* merely presents you with a blank page and assumes that you know how to select a template and color scheme, but you must consider and choose your intended output devices before creating your presentation. Templates and color schemes are grouped according to output device so the fonts and colors you can use in a presentation are limited by your target printer. While this can help you limit your presentations to the output capabilities of your printer, if you need to output to a variety of sources, you'll need to make significant adjustments to your presentation. Our test presentation involved output to three different sources so we had to assign a new color scheme to optimize output for each printer and, as with some of the other packages in this review, we had to reassign some fonts since the MagiCorp slide service limits fonts to only Bitstream or their own proprietary fonts.

And don't expect to dive into *Hollywood* without thoroughly exploring the documentation; this is one Windows product that demands thorough training. The inadequate tutorial makes it difficult to familiarize yourself adequately enough with *Hollywood*'s modus operandi to build a quick presentation.

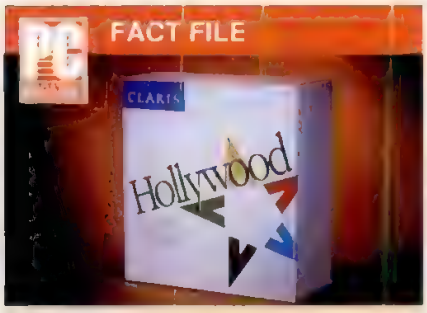
AWKWARD OUTLINER

You can create word and bullet charts by using either the annotation feature or the Outliner. Annotations can be regular formatted text placed in word-wrap boxes or *special text* that can appear rotated, mirrored, strung along a curve, or shadowed. This special text, though, cannot be edited after placement.

The Outliner is perhaps the weakest and most confusing of all *Hollywood*'s components. This feature displays icons for each existing slide of the presentation. Unfortunately, you can't add new pages in the Outliner; instead, you must create them in the chart view then add text manually or import it from an ASCII file. If you haven't previously created pages for each slide in the chart view, beware: *Hollywood* will dump all of your imported text on one page. You'll have to return to chart view, create new pages, then go back to the Outliner and insert the page break icons in the appropriate places to remedy the problem.

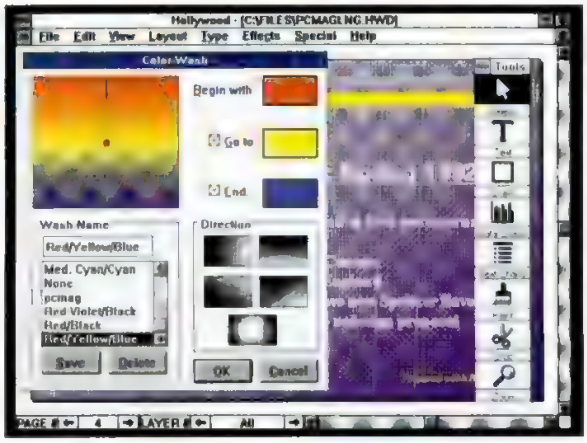
Even more frustrating is the way the Outliner uses its WYSIWYG interface. Most text placed on word charts is 18 to 24 points or larger, and the Outliner displays all text at its actual size; when combined with text wrapping, only a very small amount of text can be viewed at once. Moreover, since white text becomes invisible on the Outliner's white background, you are likely to lose sight of it.

To create graphical charts, you simply select a type from the generous selection in the chart gallery, then either add data manually to the spreadsheet-like data editor or import it in either *Lotus 1-2-3* (.WK1) or *Microsoft Excel* (.XLS) format. Although you can supposedly control the placement of labels, titles, and legends, these elements are an integral part of the chart and cannot be reposi-

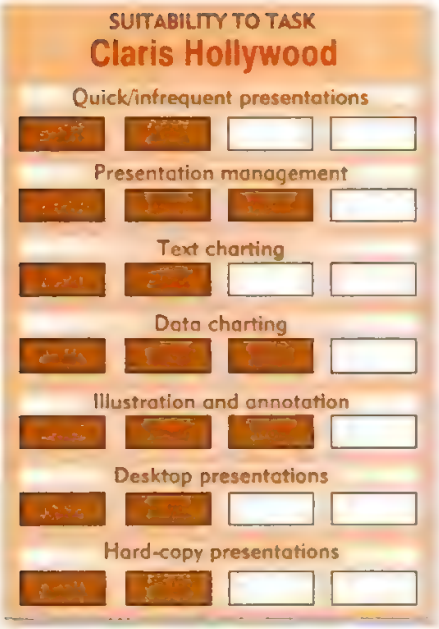


Claris Hollywood
Claris Corp., 5201 Patrick Henry Dr., Santa Clara, CA 95052; 408-727-8227.
List Price: $499.
Requires: 2MB RAM recommended, 6MB hard disk space (12MB recommended), EGA graphics adapter, mouse, DOS 3.3 or later, Microsoft Windows 3.0 or later.
In Short: There's plenty of substance in this stylish *Claris Hollywood* package, but much of its star-quality is eclipsed by an awkward and recalcitrant interface. You can create stylish presentations with this program, but not without a fight.

CIRCLE 458 ON READER SERVICE CARD



If you can find *Claris Hollywood*'s awkwardly arranged color menus, you'll be rewarded with some spectacular effects. One of the most special effects is the program's ability to create a three-color gradient fill or color wash.



tioned with accuracy. For instance, you can place legends above, below, right or left of the chart but you cannot move them closer to the chart or further away from it. In addition to the standard chart types, *Hollywood* can deftly produce organization charts by assigning different box types to each level in a hierarchical structure created in the Outliner.

ENHANCING YOUR SLIDES

Hollywood has a full set of vector drawing tools, including Beziers, as well as pixel-based paint tools. You can use the paintbrush and spray with an assortment of brush styles and thicknesses to create *paint objects*, but these are not editable on a pixel-by-pixel basis. Beziers, like other draw objects, cannot be edited by node and become noneditable once a tool is deselected. You can resize all objects created by the paint and draw tools (in fact all graphics elements) by manipulating graphics handles or by using the "object specs" dialog. This dialog lets you specify the exact dimensions for resizing and relocating a graphic element on the slide.

Once you're finished creating your slides, you can view them using the slide sorter. This feature lets you view and rearrange your entire presentation, but you can't drag slides to reorder them; instead you must cut and paste to change their positions. The program also includes a Windows-based runtime screen-show utility that lets you use just one screen effect per presentation. You can, however, use the program's automatically generated progressive builds with a transition effect, or override them completely.

> The Outliner is perhaps the weakest of all *Hollywood*'s components.

Overall, the slide output is good. On our testing, the only difficulty the program had was in making the background of a logo transparent. Our laser printer and color printer samples were also sharp.

Claris Hollywood certainly has the ability to let you build dazzling presentations, but not without a fight. You'll need to work at its idiosyncrasies to make it do the job. If your primary need is word charts, you would do well to look at the superior outliners in *Aldus Persuasion* and *Freelance Graphics for Windows*. ■

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HEFTY HEFTY HEFTY

WIMPY WIMPY WIMPY

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> *PC Magazine*
> *"Editor's Choice"*

Then there's Designer's poster-size 132″ by 132″ drawing area. Corel's is a mere 17″ by 17″ – leaving you to strip pieces together for larger drawings.

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If you have questions about using Designer, you can turn to help screens *or* our 24-hour telephone support. But you won't find any help screens in Corel Draw. And don't bother to call them after hours.

Features	Designer	Corel Draw
Drawing layers	64	1
Dimensioning	Yes	No
Object snap	Yes	No
Maximum drawing size	132″ × 132″	17″ × 17″
Edit in full color	Yes	No
Clip art images	Over 1,700	750
Type 1 fonts	180	0
PageMaker 4.0 filter	Yes	No
On line help screens	Yes	No
24-hour support	Yes	No

> **The experts' verdict: "No contest."**
> *Software Digest* gave Designer five stars to Corel's three, concluding: ***"Designer provides the best overall free-form graphics package. It offers state-of-the-art features, good performance, and unmatched ease of learning and use in a sophisticated package."***

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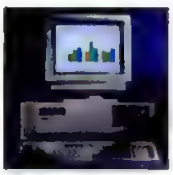
Designer system requirements: 286 (386 recommended) IBM PC or compatible, or PS/2. 1 MB RAM (2 MB RAM recommended). 20 MB (or larger) hard disk. Windows 3.0. DOS 3.1 (or higher). Mouse or digitizing pad. Windows-compatible monitor.

When Buyers Rate ZEOS®:

Support: How Mail-Order Vendors Stack Up



What Buyers Say	CompuAdd Corp. *CompuAdd 325* (with 32K-byte cache) $2,881	Dell Computer Corp.* *Dell System 325P* (no cache) $3,144	Gateway 2000 *Gateway 2000 25MHz 386* (with 80M-byte hard drive, 32K-byte cache) $2,090	Northgate Computer Systems Inc. *Northgate Elegance 386/25* (with 64K-byte cache) $2,839	Zeos International Ltd.* *Zeos 386-25* (includes AmiPro, 1-2-3 for Windows, no cache) $2,540
How long does it take to get a support representative on the phone? (most frequent answer)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Technical competence of support representative (10 is best)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
How long does it take for the vendor to solve your problem? (most frequent response)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
If your job depended on it, would you recommend buying more PCs from this firm?					
Overall rating for service and support (10 is best)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NOTES: Customer satisfaction results were compiled from PC Week's survey of PC managers whose organizations have purchased mail-order PCs. 15 customers of each vendor were surveyed.

Prices and specifications shown were supplied by vendors, each of which was asked for a quote on its lowest-priced 25Mhz 386 machine with 4M bytes of RAM, dual floppies, a 100M-byte hard drive, 14-inch Super VGA monitor, keyboard, mouse, Windows and DOS 5.0. Any changes to the configuration or no-cost options are shown. Prices were gathered by calls to each vendor between Oct. 3 and Oct 14, and include tax and shipping charges.

*System is upgradable.

Chart Reprint from October 21, 1991 issue of PC Week. *Reprinted by permission.*

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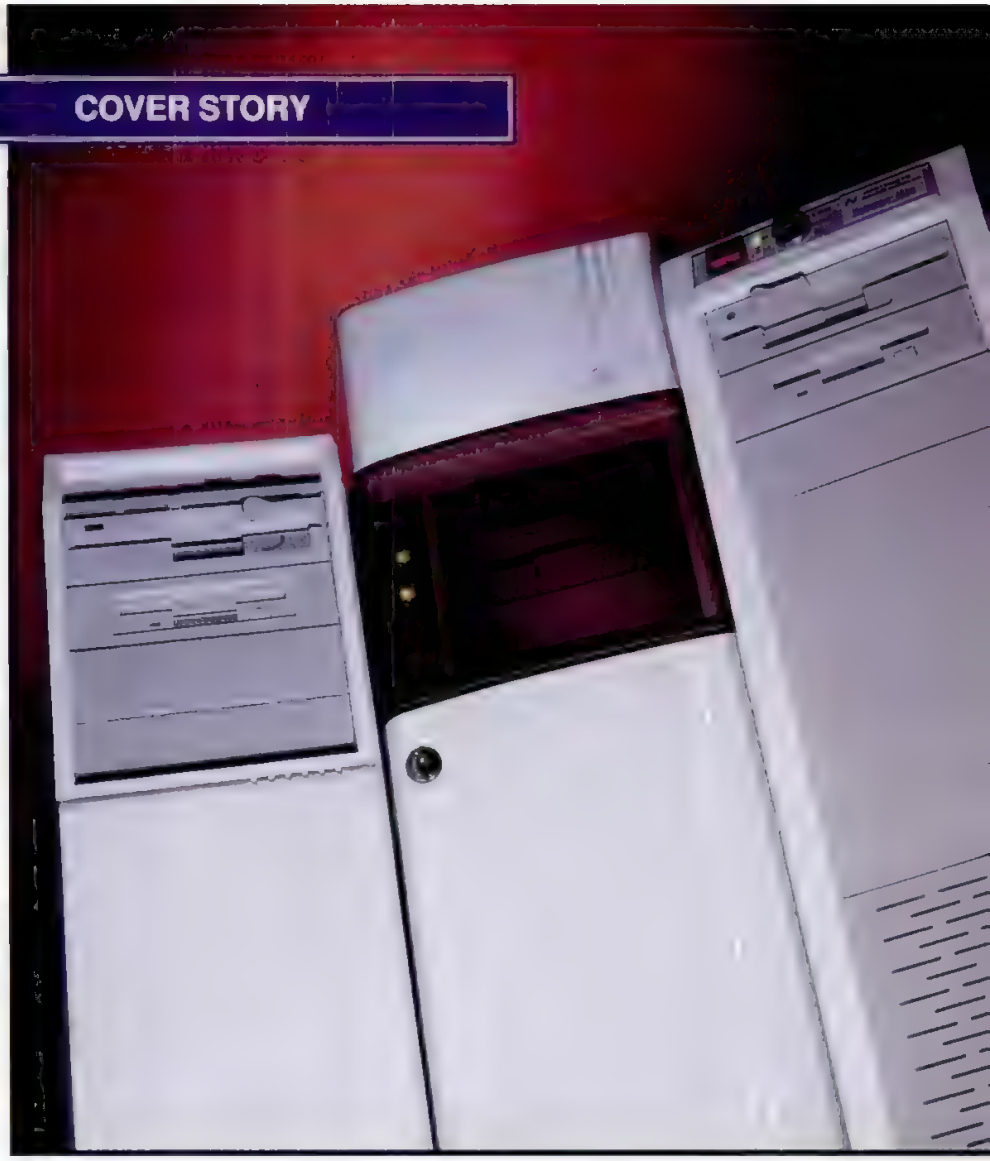


486/33

File Servers

What's the best file server you can buy? PC Magazine Labs invited 22 vendors to configure their 33-MHz EISA and MCA 486 PCs to run a busy network. Here's what they sent and what we found.

by Frank J. Derfler, Jr.

"Server" is an overused word, and there are many kinds of servers on local area networks. In this review, we look at 33-MHz 486-based EISA- and MCA-bus computers that 22 leading manufacturers believe you should use as servers on a *NetWare* network.

The companies provided us with a diverse mix of machines; the price range is from about $5,100 to more than $20,000, and the average is about $10,000. The wide price difference is

In This Review:

ALR PowerPro VM 486/33
Amkly 486/33E
BLK 486/33 EISA
Compaq Systempro/LT 486/33-510
CompuAdd 433E
Dell PowerLine 433DE
Everex STEP Megacube
Gateway 486-33 EISA
Hertz 486/33Ei
IBM PS/2 Model 95 XP 486
Insight 486-33 EISA
ME 486-EISA/33
National Micro Systems Flash Server 486-33 EISA
Northgate Elegance 433e
Samsung System Master 486/33TE
SST 486-33ME
Swan 486/33E
Systems Integration Associates SIA 486/33E
Tangent Model 433e
Tri-Star Flash Cache 486E
Wang EC 480/33C
Zeos 486-33E

the result of different configurations provided by the vendors in response to our open-ended request for a *NetWare* server.

Because *NetWare* uses caching superbly, we saw few differences in server performance. Instead, these machines differed in their configurations, their capacity for carrying peripherals and memory, and the subtle comfort level provided by the vendor. But before we discuss the products, let's look at what a server does and the features it needs.

CLASSIC SERVER ROLES

The three classic roles for a network server are print server, communications server, and file server, and each role involves separate software. A smart network administrator can choose several ways to set up these shared services. For this review, we told the vendors only that we wanted to set up a system as a *NetWare* file server.

Modern file servers do much more than provide networked PCs with access to shared files and subdirectories. They have become hosts for database engines that provide simple responses to application programs' complex queries; they communicate with uninterruptable power supplies and take appropriate actions when the power goes out; they run network management and monitoring programs; and they even hold hubs for 10BaseT unshielded twisted-pair wiring systems. These tasks rely on fast disk storage, a large amount of memory for cache, and a fast internal bus architecture.

A PC acting as a print server gathers print jobs sent by applications running on networked PCs, holds them in a queue on the server's hard disk, and feeds them to one or more printers attached to the server. This server can typically handle multiple print queues that feed as many as five printers attached to the PC. You could dedicate a powerful EISA or MCA 486/33 to the task, or you can connect shared printers to several networked client PCs.

Communications servers come in many flavors. PCs acting as communications servers can provide access to a pool of shared modems, act as a bridge or router to move packets of data between LANs, or provide remote access to people calling in through modems. Communications boards such as those reviewed in the September 10, 1991, issue of *PC Magazine* ("Smart Links Between LAN Segments" and "Dialing Up the LAN") often contain their own 186-class processors, which relieves the host PC's CPU of much of the communications burden, but the communications boards still must move information across the PC's data bus.

Many network administrators combine the print, communications, and file-server functions into one PC. That machine becomes "the server," but it really supports many different operations.

REVIEW CRITERIA

We asked companies to provide us with a currently produced computer with a 486/33 CPU and either an EISA or an MCA bus. The system must be optimized as a server for a Token-Ring LAN running *NetWare*, Version 3.11, and must be able to service up to 32 client PCs. Unlike our usual PC reviews, we did not specify an exact configuration; each company equipped its offering with the components it felt would best fit the bill. Accordingly, the servers vary widely in terms of storage capacity (from 400MB to more than 3GB), RAM (from 8MB to 64MB), and video subsystems (from Hercules monochrome to 1,024-by-768 color).

We received systems from ALR, Amkly, Blackship, Compaq, CompuAdd, Dell, Everex, Gateway, Hertz, IBM, Insight, Micro Express, National Micro Systems, Northgate, Samsung, SST, Swan, SIA, Tangent, Tri-Star, Wang, and Zeos.

We also requested the AcerPower 500, American Mitac 4280G, Arche Legacy 486/33, AST Premium 486/33TE, AT&T StarServer E, Austin 486/33E, Digital Equipment Corp. 486/33, LSE 486/33E and the Peregrine 433T. We did not receive systems from these vendors; either the products were not yet shipping, the companies declined, or they simply did not respond to our request. Note that AST was phasing out its Premium 486/33TE, and the company didn't have another model that fit our profile.

Four other products were dropped because of problems that developed during testing (as discussed in the sidebar "Problem Report: Four Dropouts, One Underachiever"). These include the HP Vectra 486/33T, Iverson 486-33 EISA, NCR System 3445 (an MCA PC), and Wyse Decision 486/33.

WHAT DOES IT TAKE?

It's easy to list the elements of a good multipurpose server: the biggest and fastest hard disk you can afford, a fast data bus, four to six usable expansion slots, enough RAM for the hard disk and the number of users, and a CPU that's powerful enough. The most important element to server success is a fast hard disk. Modern disk-caching software can overcome the negative impact of a slow hard disk on subsequent requests for the same or related data, but this software won't speed up common tasks such as loading application programs from the server.

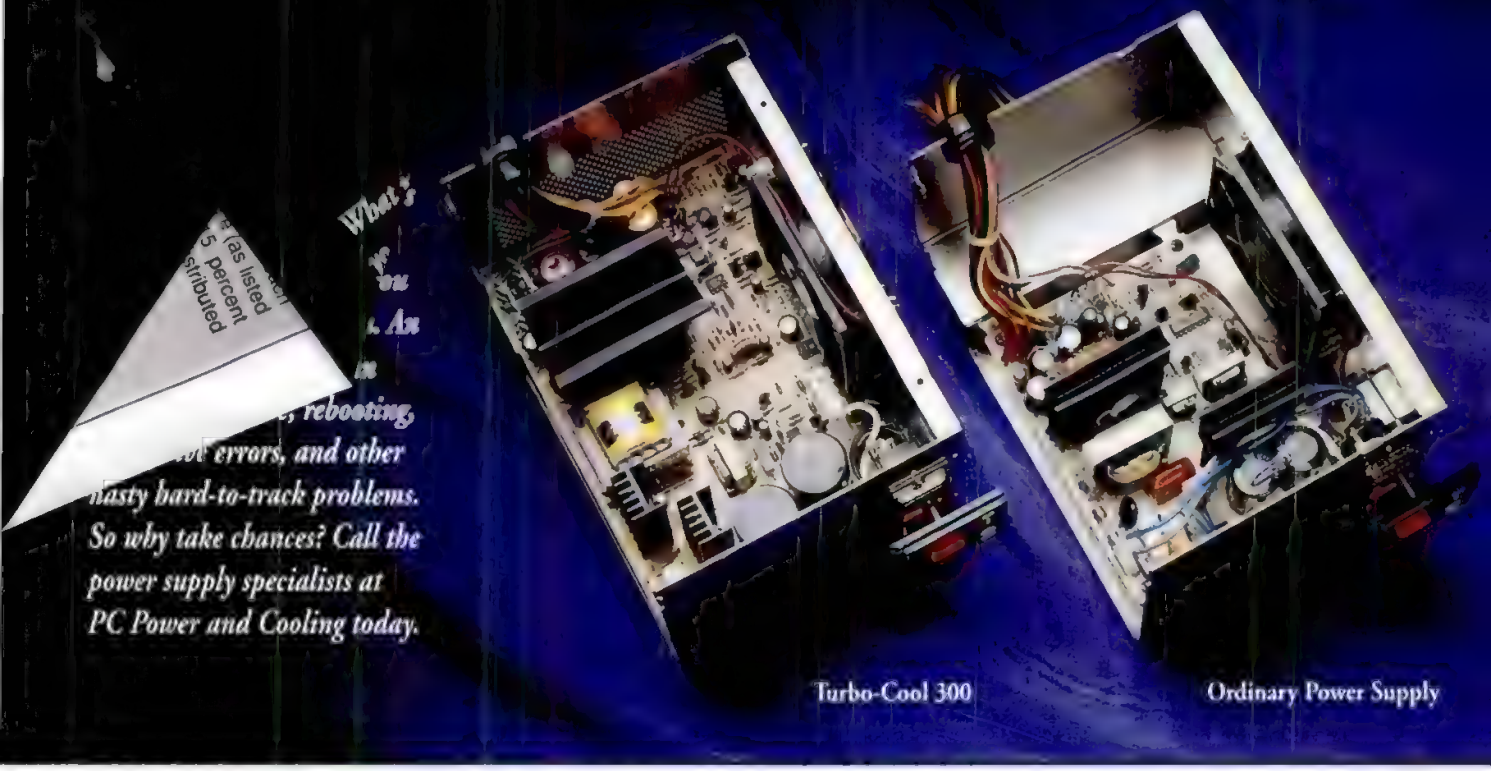
RAIDS AND SLEDS

Data security and fault tolerance are also important storage issues, which may be addressed with redundant arrays of inex-

OUR CONTRIBUTORS

Bruce Brown is a contributing editor of *PC Magazine*.
Frank J. Derfler, Jr. is workgroup systems editor of *PC Magazine*.
Kellyn Betts, Joseph Desposito, Patrick Honan, Greg Pastrick, Wendy Dugas Pérez, and **John R. Quain** are frequent contributors to *PC Magazine*.
Alan M. Stoughton is the PCs project leader in PC Magazine Labs.

LOOK AT THE INSIDE STORY ON POWER SUPPLIES.



errors, and other nasty hard-to-track problems. So why take chances? Call the power supply specialists at PC Power and Cooling today.

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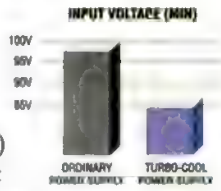

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Turbo-Cool's superior independent-regulation design keeps output voltage tolerances 20 times tighter than that of an ordinary power supply. This exceptional stability improves hard drive reliability during critical access periods.

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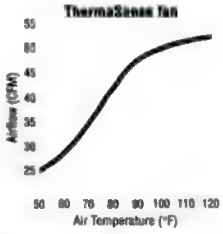

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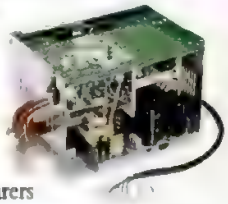
Turbo-Cool 450

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CIRCLE 080 ON READER SERVICE CARD

PRICE/PERFORMANCE INDEX

The Northgate unit found the sweet spot on this chart (good performance and features, a reasonable price, and Novell certification), though the highest performance/features scores came from the Hertz and SIA PCs. The Dell, Insight, and SST units had better-than-average performance/features scores. The wide range of scores along the performance/features axis reflects the success of the many different configurations we saw in this roundup.

The Northgate Elegance 433e, with its well-rounded and sensible configuration (32MB of RAM and 676MB of storage), has it all: a performance/features score that's better than average and a dynamite price of $7,449, which together create a higher-than-average Bang for the Buck score. This server is even Novell-certified.

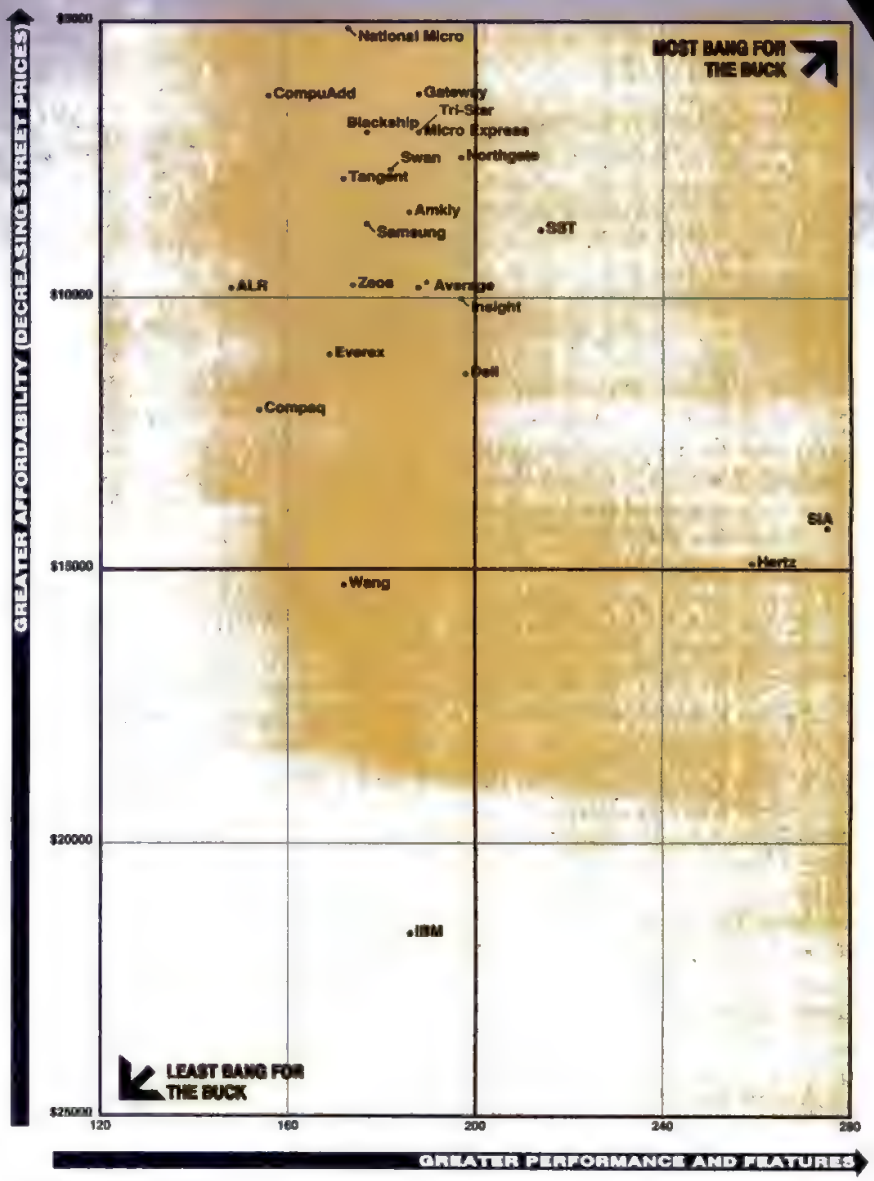
The Hertz 486/33Ei and SIA 486/33E each scored more than 250 points on the performance/features axis; these exceptional results are due to the SIA 486/33E's massive storage capacity (3GB) and the Hertz 486/33Ei's enormous RAM bank (64MB). Both systems have excellent expandability, a rock-solid construction (including built-in cooling fans), Novell certification, and hefty price tags.

We limited the effect of excessive RAM and giant drive capacity, because at some point a larger storage size ceases to effect proportionately better results. Therefore, we gave a system with no more than 16MB of RAM 1 point for every megabyte (up to 16 points), but servers with more than 16MB of RAM received 16 points, plus three-quarters of a point for every extra megabyte. Similarly, a PC with more than 1GB of storage received 1 point for every 25MB of RAM (40 points), plus three-quarters of a point for every extra 25MB.

THE DATA POINTS

The performance/features axis of the Bang for the Buck chart is based on eight data points: two of PC Magazine Labs' LAN benchmark test scores, installed RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (miscellaneous items such as free bundled software, on-site service, FCC Class B certification, Novell certification, an extended warranty policy, flash memory, and multiprocessing capability). A set of weighting factors has been applied to [illegible] formance makes up ha[illegible] tures make up the other h[illegible] found in the Software Librar[illegible] Editorial Forum as 05BANG.

Location on the *y*-axis is t[illegible] system's tested-configuration pr[illegible] in the fact file). We applied a [illegible] discount to the list prices of dealer-c[illegible] systems to approximate street prices.



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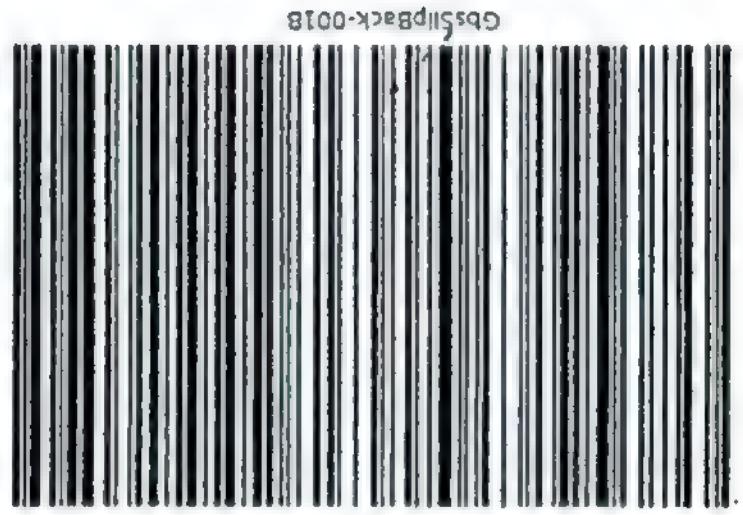

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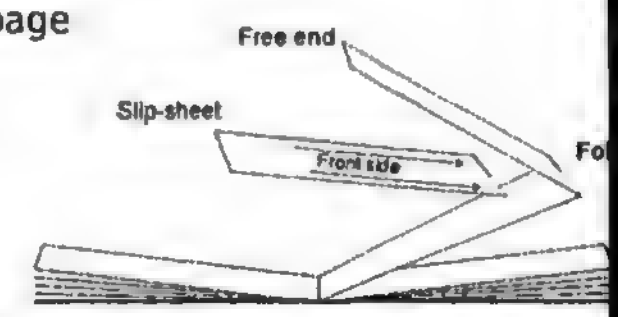

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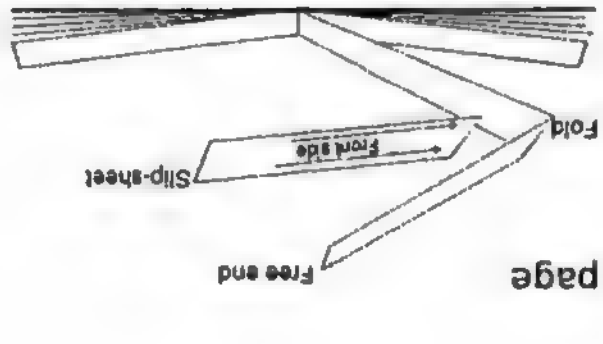

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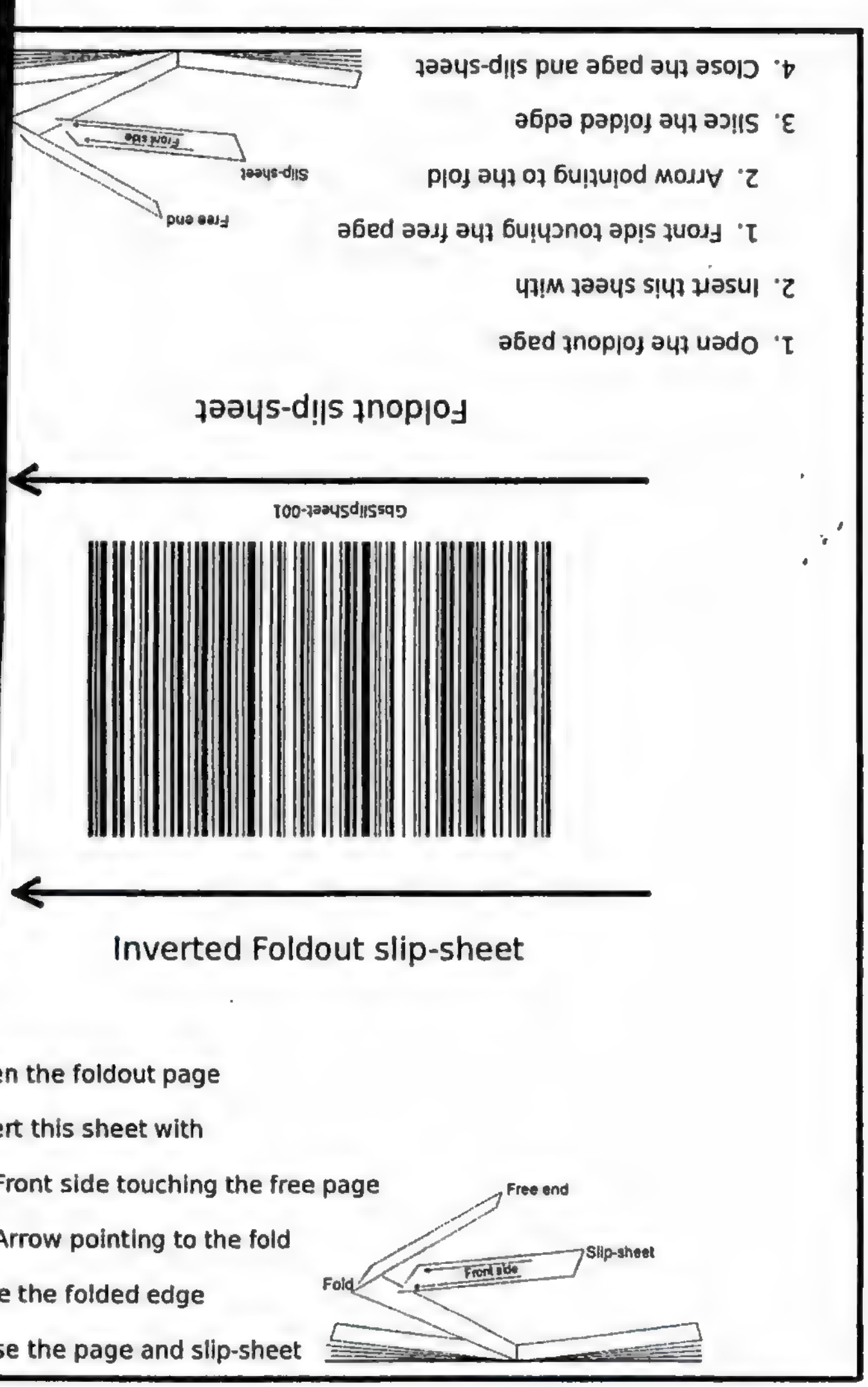
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ACC 1

pensive disks (RAIDs, also known as drive arrays) or single large expensive disks (SLEDs). Drive arrays are two or more hard disks (and higher-end products often contain five hard disks) combined into one unit that can move data into storage in parallel bit stream, in such a way that the hard disks act as one volume. They provide varying degrees of reliability, based on the number of hard disks and the sophistication of the controller, and they achieve highly efficient read and write actions. Many companies, including ALR, Compaq, Dell, IBM, and Northgate, offer disk arrays. It is also relatively simple to add an array like the Core CPR series through a SCSI adapter and cable.

On the other hand, single large disks are fast, getting cheaper, and very reliable, though you will still need to mirror two hard disks if you want a high degree of reliability through redundancy.

To add confusion to the issue of arrays versus SLEDs, it is possible to configure an array as a SLED, so that each hard disk can independently seek. The Dell PowerLine 433DE offers this option, but you lose the drive array's redundancy feature while responses to random-read requests improve. You can set up several SLEDs to perform split-disk seeks in the same way. Since disk systems can receive a four-to-one or better ratio of read requests to write requests from typical PC applications, anything you can do to improve read-request servicing will directly improve network performance.

As a tip, if you have an active database file that is larger than 100MB, you often can improve performance by using the capability of an operating system like *NetWare* to span several hard disks, treating them as a single volume. Several small, fast hard disks can respond separately and quickly to read and write requests on the same very large file.

The subject of disk controllers with built-in caching also causes confusion and contention in the server world. Modern server software does an excellent job of caching reads and writes, and the PC you are likely to use as a server can carry more than 16MB of low-cost RAM. Therefore, you don't need to pay extra for a controller that caches only the data that comes from or goes to the RAM cache. The main theoretical advantage of a caching controller is that it is on the hard disk side of the expansion bus; if the bus is a bottleneck, a caching controller can help. Yet it takes huge amounts of data to saturate the 16-bit ISA bus, let alone a 32-bit bus.

In our group of review machines, we had 19 SCSI, two ESDI, and one IDE hard disk system. Not surprisingly, there was little differentiation in performance on the Hard Disk Access Load portion of PC Magazine Labs' LAN benchmark test. The vendors provided hard disks ranging from 338MB to 2GB in size.

COUNT THE SLOTS

Besides fast access to stored data, you will also need to avoid bottlenecks where the network meets the server. As a practical estimate, four Ethernet LAN adapters can deliver data to a server at a rate of up to 30

PROBLEM REPORT: Four Dropouts, One Underachiever

by Alan M. Stoughton

In this roundup of 22 EISA and MCA 486/33 servers, 4 machines were unable to complete our tests, and the IBM PS/2 Model 95 XP 486 showed some poor test results. The HP Vectra 486/33T, Iverson 486-33 EISA, NCR System 3445, and Wyse Decision 486/33 all experienced some difficulty in handling the four-Token-Ring implementation we chose for our test-bed.

The ongoing problems PC Magazine Labs experienced with even a few of the best-known servers suggest that skilled LAN users may also want to consider single-source shopping for file servers, LAN server cards, and LAN operating systems. If something goes wrong, you thereby avoid the possibility (and likelihood) of finger-pointing among suppliers.

THE DROPOUTS

The HP Vectra 486/33T ran all parts of PC Labs' LAN benchmark tests except the Directory Access test. The system randomly locked up during this test, and the representative HP sent to PC Labs to evaluate the problem suspected a conflict between the system's video card and the Madge Networks Token-Ring network interface card closest to it. The representative could not find an on-site remedy, and the company subsequently stated its commitment to resolving this issue promptly.

The Iverson 486-33 also could not handle the full complement of Madge Networks' Token-Ring adapters. Iverson suspected a power-supply capacity problem, but even after sending a second unit with a larger power supply, the server lost all video when we installed the third of four NICs. PC Labs tried different combinations of slots for all of the adapters but was unable to get the system to operate properly. The company had no explanation for the problem.

The NCR System 3445 came with 32MB of RAM installed, but workstations would not log on to the server when set to recognize all 32MB of system memory. The PC worked fine when it was forced to recognize only 16MB of memory, but we were unable to get the system to function under the full 32MB, and NCR did not respond to our repeated phone calls. Since the 16MB configuration would have put this machine at a disadvantage, PC Labs chose to drop it from the review.

The Wyse Decision 486/33 experienced problems when more than one Madge Token-Ring board was installed. Though a replacement machine was sent to PC Labs, the system also experienced problems that forced us to drop the system from the review.

IBM'S MODEL 95

Though the IBM PS/2 Model 95 XP 486 completed the benchmark tests, the combination of this system and the four Madge Networks Ringnode network adapters provided poorer test results than did similar EISA machines. Though the board uses 24-bit addressing, the MCA card uses a 16-bit data path, whereas the EISA cards had true 32-bit data paths. IBM recommends its own boards, though these cards also have a 16-bit data path while the PS/2 Model 95 has a 32-bit MCA bus. IBM says its cards handle a multiboard configuration effectively because of the way the cards implement their bus arbitration and data transfers; by the time IBM suggested the change, however, testing had ended. ■

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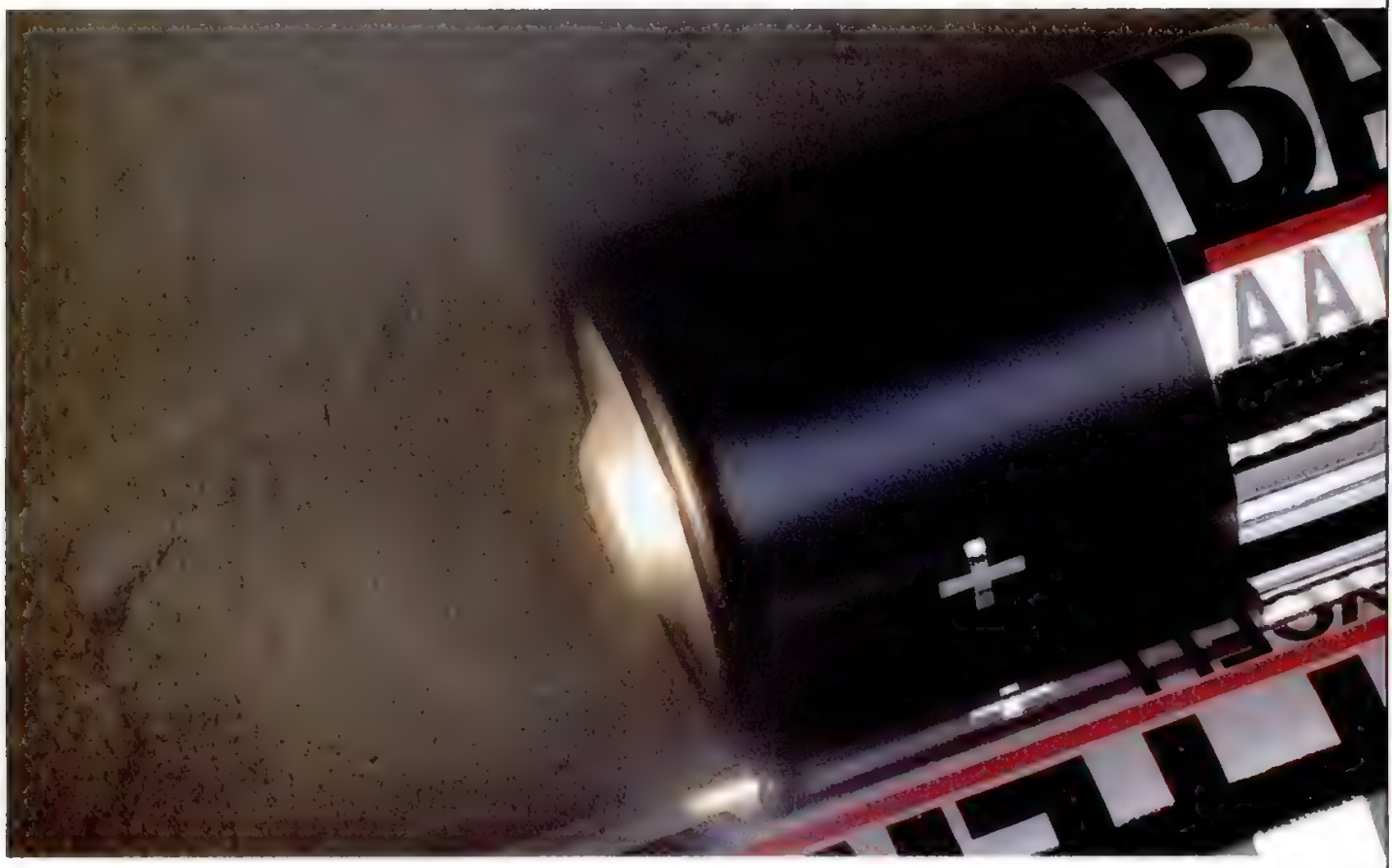
Computing Will



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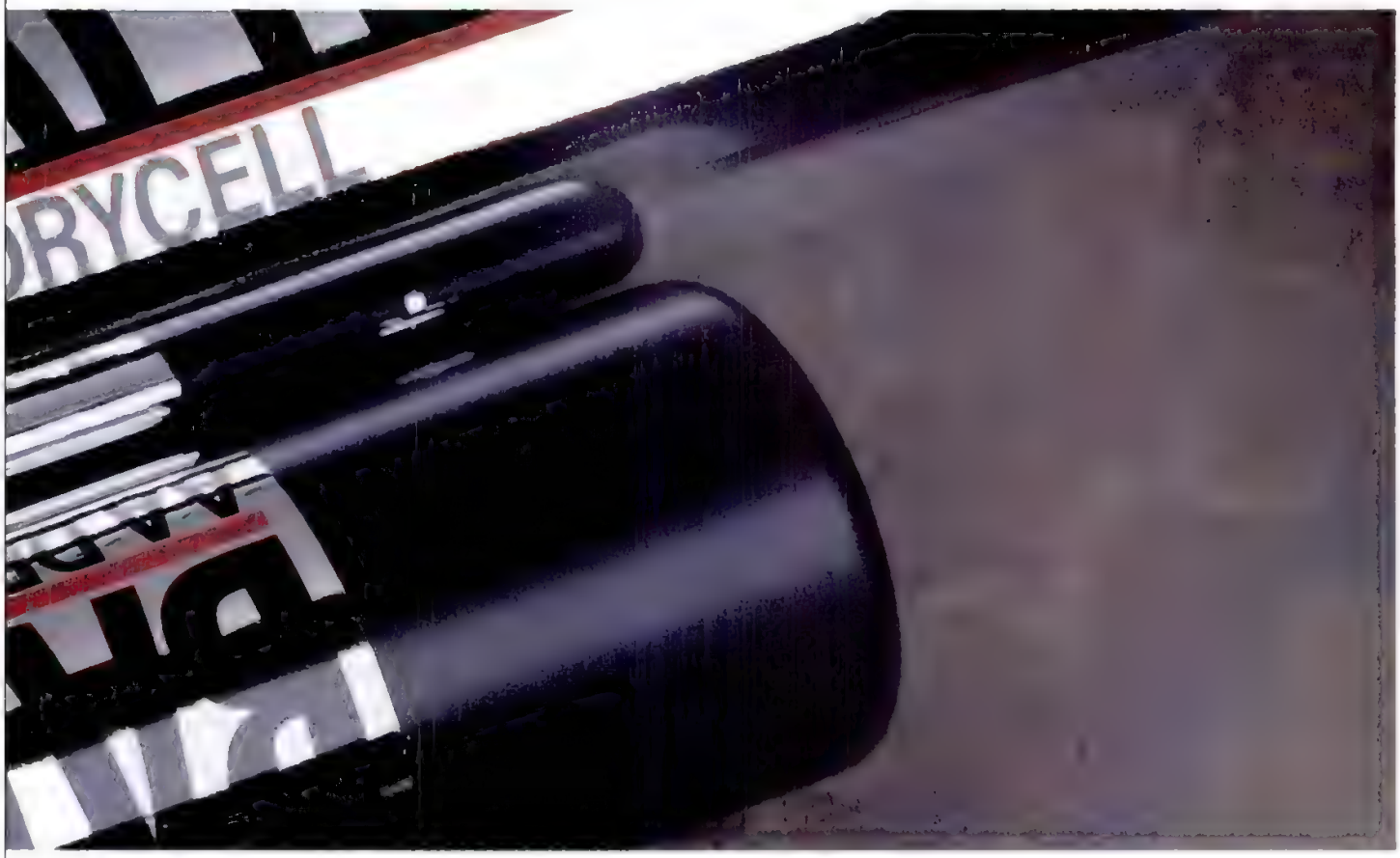

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CIRCLE 197 ON READER SERVICE CARD

megabits per second. Each adapter has to unload fast and get back to servicing the cable; therefore, the ideal server needs an internal bus able to move data in 32-bit-wide blocks and to give control to bus-mastering adapters.

Since a single networked 20-MHz 386 PC can pump data through the cable at a rate exceeding 1 Mbps, it doesn't take many active nodes to saturate the media access control system of Ethernet, ARCnet, or Token-Ring topologies. By splitting the network and using multiple LAN adapters in the server, you can avoid saturating the cable.

The most-sophisticated LAN operating systems, such as *NetWare*, Banyan Systems' *VINES*, and Microsoft's *LAN Manager*, can accept data from four active LAN adapters in the server, so the server needs plenty of expansion slots. Considering the potential need for four LAN adapters, a communications adapter, an internal modem for trouble calls, and perhaps a separate adapter for a file-backup device, it isn't unreasonable to desire six free expansion slots after adding the video card, disk controller, and incidental I/O to the server. On a high-performance server, at least six slots on the motherboard should have 32-bit addressing.

All of the machines in our review, except the Insight 486-33 EISA, had at least four open slots before we added the LAN adapters. Though the Insight system came with eight EISA slots, the company sent three separate controllers for the hard

EDITORS' CHOICE

- **Hertz 486/33Ei**
- **Northgate Elegance 433e**
- **SIA 486/33E**

For this review of mainstream file servers, PC Magazine Labs tested 22 high-capacity, high-dollar 486/33 systems with EISA or MCA architectures. The three systems receiving an Editors' Choice are heartily configured; more important are their features and options, which make these three PCs especially well suited as file servers: The Northgate Elegance 433e is a turnkey *NetWare* computer with a laudable price, the Intel-manufactured Hertz 486/33Ei has solid construction inside and Hertz's excellent network-specific support, and Systems Integration Associates' SIA 486/33E has easy access to components and technology that's designed to make the server reliable and secure.

Northgate gives network administrators everything they need—a turnkey system with hard disks optimized for *NetWare*, excellent expansion capability and good performance, and a more-than-satisfactory price. Unlike other vendors, who will sell a PC but let the network administrator configure it, Northgate preconfigures every Elegance 433e to each network administrator's needs. Plug it in and it works. The machine we received came with 16MB of memory and 676MB worth of storage, a 128K external cache, and a retail price of $7,449.

The $14,885 Hertz 486/33Ei is a top-notch server as well, thanks to its solid and well-laid-out case, excellent expansion room, fine cooling, and network-specific support. This system, an OEM version of the Intel 403E, came configured to the max, with 64MB of RAM (a bit of overkill for most servers even in the era of $50-per-megabyte memory) and 2GB of disk storage. Much of what we like about the Hertz system would apply to most any reseller's system based on the Intel 403E chassis; Hertz goes an extra step with its network training, on-site service, and toll-free technical support.

Another tank—the SIA 486/33E—wins an Editors' Choice for its rock-solid construction; attention to security features; and SIA's commitment to the network community, which is shown in such offerings as a rack-mount option and a cooling unit that senses and shuts down an overheated system. Though the unit we received had a high price ($16,745), it also had 3GB of storage and 32MB of RAM. This may be too much for your network needs, but SIA will configure the system to meet your requirements.

COMPAQ, IBM, AND DELL

Based on its standout performance, the Dell PowerLine 433DE might have won an Editors' Choice. Because of a communications mix-up, however, Dell sent us the desktop-based PowerLine 433DE instead of the tower-based Dell PowerLine 433SE (*D* for desktop, *S* for server). Components and options are similar, so performance should be the same. But we can't recommend a small-footprint PC as a serious file server, and we won't honor a product that we didn't test. Based on our experience with the PowerLine 433DE, if you opt for the PowerLine 433SE tower unit with its additional slots and drive bays, we believe you will be happy with your decision.

IBM, COMPAQ FALTER

Two products should have fared better, based on their pedigrees and price: the Compaq Systempro/LT 486-33/510 and the IBM PS/2 Model 95 XP 486. The EISA-based Compaq PC came with an ISA-based IDE hard disk controller that couldn't have helped performance, and the Micro Channel–architecture IBM server faltered when we installed Madge Networks' Token-Ring MCA network adapters. (IBM initially agreed to PC Labs' use of the card.) The combination made for poor performance; we believe another card, particularly IBM's own, would have enhanced performance.

disk, tape backup, and CD-ROM drive instead of connecting them all to a SCSI card. Several machines had six and seven free slots, and the Everex STEP Megacube offered eight open EISA slots.

In addition to the slots, you need a power supply with enough connectors for the storage devices you want to install; it must also be able to supply the necessary current, particularly on the +5 volt line. Of the 22 tested servers—these PCs all came with a hard disk system, a video adapter, and four Madge Token-Ring adapters—six either posted a cautionary message about excessive power use or had other power-supply problems.

The PCs in our review had power supplies rated between 200 and 450 watts. But in addition to the amount of power, you might also want to know how many peripheral connectors each power supply has, so that you can avoid needing Y splitters for extra devices. The SIA 486/33E provides eight connectors on its generous 450-watt power supply, and the Zeos 486-33E gives four connectors on a supply with the same rating.

HOW MUCH RAM?

ALR offers the ability to load a whopping 305MB of RAM into its ALR PowerPro VM 486/33. Blackship's BLK 486/33 EISA and Dell's PowerLine can hold up to 96MB of RAM, and all the systems can handle at least 32MB of RAM. When given the choice of how much RAM to send for this review, 12 vendors sent us 16MB, 6 sent more, and 4 sent less. The obvious question is, how much RAM is enough? The not-so-obvious answer depends on what you want to do.

Since we asked the vendors to configure these machines as *NetWare* servers, let's look at the software first. *NetWare* is quite easy on memory. You can determine how much memory *NetWare*, Version 3.11, needs by multiplying the number of megabytes in a volume by 0.023, and then dividing by the block size (typically 4). Last, you add 4 to that number to account for the operating system's overhead. As a general rule, a *NetWare* file server with a 600MB hard disk needs about 8MB of RAM. There are different factors for Unix and Macintosh file volumes.

NetWare will allocate all remaining memory for the disk cache. The amount of memory actually used for caching will depend on how people and applications use the server. If only a few megabytes' worth of files are open, the extra RAM can sit idle. By comparison, the version of OS/2 that underlies Microsoft's present *LAN Manager* version can't address more than 16MB of RAM, but *LAN Manager* needs every byte.

The picture changes dramatically if you want to run a program like the ORACLE Server for *NetWare* 386 or Microsoft's SQL Server. The ORACLE program, a *NetWare* Loadable Module (NLM), needs 9MB of RAM to run, but its maximum memory requirement depends on how the applications are written and also on the number of active users. The SQL Server can address up to 28MB of RAM. Obviously, even a 32MB system can be restrictive if you have many users active on a database server.

CPU POWER

Finally, after potential hard disk and LAN adapter-card bottlenecks are cleared, the server workload falls on the CPU. *NetWare* puts little workload on the file server's CPU. But once you run a few server-based applications, such as network management programs, UPS monitors, and communications programs, it doesn't take long to bog down the CPU.

While many servers are happily running 386 processors under heavy loads, the cost of stepping up to a 486 from a 386 isn't great. Zeos, for instance, typically charges about $300 extra for a 486 system that is otherwise configured identically to its 386 counterpart.

PCs with an upgradable CPU architecture like those offered by ALR, IBM, Zeos, and other companies provide a way to increase the system's horsepower as you add more functions to the server.

While it is smart to invest in a 486 processor, there are few reasons to opt for a multiprocessor system. Among the popular network operating systems, only Banyan Systems' *VINES* provides true symmetrical processing. If you want to use Unix as the file-handling structure under networking products like NFS, Ported *NetWare*, or one of the Unix versions of *LAN Manager*, then SCO Unix and AT&T's Unix V support true symmetrical processing. Under OS/2, *LAN Manager* runs primarily on one processor while it puts such tasks as print-job spooling on the other processor—a configuration you could arrange yourself for much less than the cost of a multiprocessor system. The bottom line: Only organizations that use Unix or *VINES* heavily should consider a multiprocessor system.

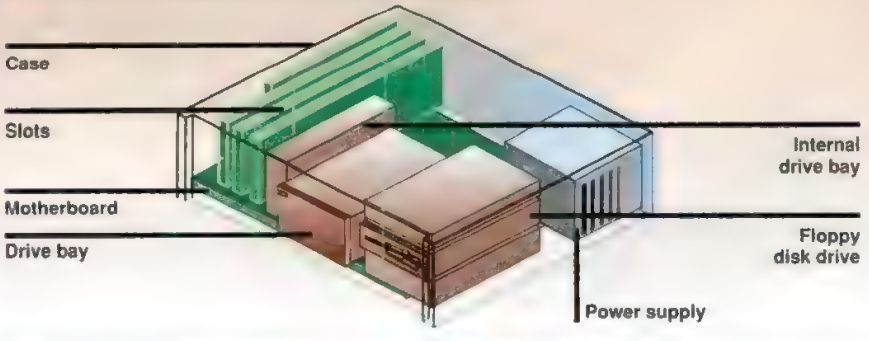
CERTIFICATION AND SUPPORT

Our reviews indicate if a PC has Novell certification, though Novell's blessing isn't a make-or-break buying criterion

SYSTEM CONFIGURATION: A GUIDE TO THE GRAPHICS

PC LABS

INTERIOR CONFIGURATION DIAGRAM



Case Options include desktop, tower, minitower, small-footprint, and slimline.

Slots The number and length of cards represent the number and length of slots on the motherboard.

Drive bay A hard disk face plate indicates external access to a bay. Options include full-height, half-height, third-height, and 3.5-inch.

Floppy disk drive A face plate indicates that either a 1.2MB or 1.44MB floppy disk drive was installed in our tested system.

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Elegance 486e features 1.2MB 5.25"and 1.44MB 3.5" floppy drives. Plus, eight 32-bit EISA bus slots that easily accommodate standard 8- and 16-bit cards as well.

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("*NetWare* Certification: A Seal of Approval, but for How Long?" *PC Magazine*, October 15, 1991). The certification process can cost a vendor thousands of dollars, and changes to *NetWare* or to the hardware can invalidate that certification.

Getting good support for the hardware is crucial, though. All the companies in this review offer at least a one-year parts-and-labor warranty for their systems. They typically provide on-site service through local dealers. Micro Express, National Micro Systems, Swan, and Tri-Star offer two-year warranties for parts and slightly different terms for labor. Read the reviews for special support arrangements, such as the free on-site service that more than half the vendors in this review include with their systems.

HOW MUCH IS ENOUGH?

So what is a server? Obviously, it is a computer that has *enough* of the major elements—expansion slots, RAM, storage, and watts. Your concept of *enough* depends on how you want to use the network. If you have between 2 and 20 PCs, and you want to keep word-processing and spreadsheet files on your server, you will get enough of everything from a system in the $3,000 to $6,000 range, depending primarily on the hard disk subsystem you want. But if you need gigabytes of storage with backup subsystems on a database server, expect prices of $10,000 and up for your hardware.

ADVANCED LOGIC RESEARCH INC.

ALR PowerPro VM 486/33

BY GREG PASTRICK Advanced Logic Research has put together an upgradable EISA package with the power and performance needed to drive a 32-node network efficiently. THE ALR PowerPro VM 486/33 tower, priced at $11,527 for the configuration we reviewed, is a certified *NetWare*-ready system with 9MB of RAM, 64K of secondary RAM cache, a pair of 200MB hard disks, one floppy disk drive, a Super VGA display subsystem, and a generous array of 32-bit slots for future system expansion. Though ALR itself does not sell *NetWare*, it markets its products through distributors that do.

From a selection of hard disks, which includes 330MB and 650MB options, ALR configured the PowerPro with two 16-millisecond 210MB Western Digital SP4200 SCSI-2 hard disks. These are connected to a BusTek BT-742A controller card that has a 32K read-ahead buffer. The SCSI adapter occupies one of the motherboard's eight 32-bit EISA slots, leaving plenty of room even after we installed four network interface cards (NICs). The motherboard, made by ALR, also has two 16-bit ISA slots and two proprietary slots for the plug-in processor and cache cards. As configured for our review, the PowerPro's Paradise PVGA1A-TK video card with 256K RAM was connected to ALR's own FlexView 2X monitor, which offered 800-by-600 resolution and 256 simultaneously displayable colors.

BIOS operations are controlled by a Phoenix ROM Plus chip. The ALR motherboard comes standard with 1MB of SIP (single in-line package) memory installed. You can add up to 49MB of 80-ns. SIMMs (single in-line memory modules) in 4MB packages to the board's available sockets, and ALR recently announced an add-in memory board that allows you to bring the system's total memory to 305MB. In the *PC Magazine* configuration, the PowerPro had 9MB of page-mode RAM with a 64K external static RAM cache; the combination was delivered from the ALR Cache PAK card installed below the processor-card slot. An upgrade to the 256K Cache PAK card is available for $795. The proprietary processor-card slot on the system board affords other upgrade options, including a dual-processor 486/33 card and a $2,495 486/50 card. The upgrade to the 50-MHz card includes a $200 rebate upon return of the 33-MHz card.

Available drive space on the PowerPro is limited to room for four half-height bays, and a swing mount on the chassis for attaching an additional full- or half-height drive. As set up for our review, the available bays were completely taken over by the two Western Digital hard disks and the 1.2MB Sankyo floppy disk drive. The only alternative to mass storage or backup-device expansion is the open swing mount. The lack of space limits the possibility of big drive arrays but doesn't eliminate it. As a radical option, ALR offers the same basic fea-

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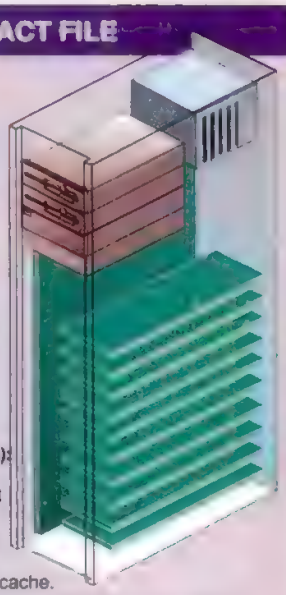

ALR PowerPro VM 486/33 Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770.
List price (tested configuration): $11,527.
Memory and processor RAM cache: 9MB 80-ns. SIMMs, 64K cache.
Disk drives and controller: Two Western Digital 16-ms. 200MB SCSI-2 hard disks, BusTek controller, 1.2MB floppy disk drive.
Display: Paradise Super VGA adapter with 256K RAM, ALR 14-inch monitor.
Monitor refresh rate: 70 Hz.
Software: DOS 5.0.
In Short: The ALR PowerPro VM 486/33 is a versatile networking platform, offering plug-in processor and caching upgrades and more than enough 32-bit EISA expansion slots to handle demanding environments. A fair price, along with Novell certification and reliable service-and-support options, make it an easy call for most system applications. About all this server lacks is room for more than five drives.

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The ALR PowerPro's performance on PC Magazine's benchmark tests was uneventful.

tures of the PowerPro in the FlexStor Gigabyte, an alternative case that comes standard with a 330MB hard disk, an 800-watt uninterruptable power supply, and six full-height drive bays for an additional $5,999.

The PowerPro's performance on PC Magazine Labs' LAN benchmark tests was uneventful. Its EISA configuration utility is thoroughly documented and quickly accomplishes the task, and the BusTek SCSI adapter comes with the appropriate *NetWare* drivers. ALR's CMOS setup includes password protection and an additional network supervisor option to change user passwords. Hard disk throughput was slightly below average, as was the server utilization during the Hard Disk Access Load test.

As stated before, the PowerPro is certified for Novell network operation. ALR offers technical support to dealers and users on both a direct line and fax line. System purchases come with the standard one-year warranty on parts and labor. Intel Service Centers, which may be reached at a toll-free number by dialing 800-468-3548, furnish on-site service. Pricing for on-site and extended service contracts varies per system configuration.

As it stands, the ALR PowerPro VM 486/33 is a versatile networking platform from a company that has a track record of delivering solidly performing and reliable servers at a price that most office budgets can justify.

AMKLY SYSTEMS INC.

Amkly 486/33E

BY BRUCE BROWN A small-footprint desktop PC seems an unlikely candidate for service as a network file server, but the Amkly 486/33E EISA-bus computer can handle the job. Though its desktop size limits you to four drive bays, one of the 5.25-inch half-height bays in our test model held two floppy disk drives. Moreover, this compact, easy-to-set-up system performed better than average on all the tests we report. These considerations, plus reasonable prices and network-oriented technical support available 24 hours a day earn the Amkly a place on the short list of servers worth considering.

Amkly Systems does not sell a full line of computers, electing instead to specialize in network servers and workstations; even so, all these machines could also be used as personal computers. The model we reviewed is awaiting Novell certification. Amkly itself does not sell *NetWare*.

The $9,945 Amkly 486/33E we tested came with 32MB of RAM and two 492MB 14-millisecond Seagate SCSI-2 hard disks, each with its own UltraStor noncaching disk controller. The Amkly's combination Canon 1.2MB and 1.44MB floppy disk drive occupied a single half-height 5.25-inch drive bay, leaving the other half-height bay free.

The Amkly system's monochrome VGA monitor had a 70-Hz vertical refresh rate at its maximum resolution of 1,024-by-768 noninterlaced. The 16-bit video circuitry is located on the motherboard itself, along with 512K video RAM expandable to 1MB. DOS 5.0 is standard, along with a customized hypertext on-line help system.

The Amkly's motherboard has a proprietary slot for a processor card that holds the CPU, up to 32MB of system RAM, a customized Phoenix ROM BIOS, and a socket for a Weitek math coprocessor. An additional memory-card slot can boost the system RAM to the maximum 64MB. You can get lower-powered CPU cards for this system, but the highest CPU upgrade currently available is to a 486/33. No external RAM cache came with the system, although the company has announced that a 128K cache option should be ready by the time you read this. If your workstations are constantly accessing server files, it would help to have these files in a cache.

You can upgrade the Amkly 486/33E's flash ROM BIOS by disk or by downloading from the vendor's bulletin board. As a protection against inadvertent changes, the Amkly requires you to push a button inside the system to change the BIOS. Special features in the BIOS include password support, special network keyboard instructions, and a server mode that allows a crashed system to reboot without making you re-

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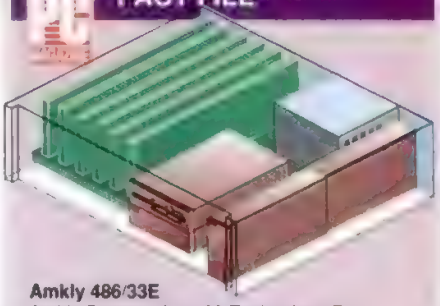

Amkly 486/33E
Amkly Systems Inc., 60 Technology Dr., Irvine, CA 92718; 714-727-0788.
List price (tested configuration): $9,945.
Memory and processor RAM cache: 32MB 70-ns SIMMs
Disk drives and controller: Two Seagate 14-ms, 492MB SCSI hard disks, two UltraStor controllers, 1.2MB and 1.44MB floppy disk drives.
Display: Trident VGA adapter with 512K RAM, AMKLY 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0
In Short: The Amkly 486/33E is a small-footprint EISA-bus system that can hold up to 112MB of RAM. It has four drive bays and five free EISA slots (including a single controller) before you add network cards. Although it has limited expansion capabilities, this server's price and performance are fine. Technical support is network oriented and more accessible than usual.

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set your network configuration files.

The drive configuration, which consisted of matched, duplexed 3.5-inch SCSI-2 drives and two controllers, was geared for speed under a scheme that saved alternate data sectors to different drives. This kind of duplexing splits the data between the two drives rather than mirroring it to both. While this method gives good performance without disk caching, the drawback is that if one of the two drives fails, your data is in trouble because there is no data redundancy. You could have drive mirroring if you choose, but it would be under a different configuration using a single controller.

The Amkly's case has three front-accessible drive bays: two 5.25-inch half-height (one occupied by the combination floppy disk drive) and one vertical 3.5-inch bay. This bay and the internal 3.5-inch bay hold the duplexed SCSI-2 hard disks. The 200-watt power supply had four leads, one for each drive bay. Two fans gave ample ventilation.

A proprietary slot holds the processor card; you will lose a slot if you install the optional memory card. The remaining six—all EISA slots—are bus-mastering. Two drive controllers on the tested system left four EISA slots free—just enough for the four NICs we installed.

Amkly sells computers solely through value-added resellers (VARs) and independent software vendors (ISVs). The system's one-year parts-and-labor warranty is backed by on-site support via Texas Instruments service centers, which have more than 400 locations nationwide. A three-year warranty and an on-site service extension costs a reasonable $500. Technical support is always available: 24 hours a day, seven days a week, with Amkly network support specialists always on call.

The Amkly system's price is quite reasonable, considering that you get nearly 900MB of storage on two hard disks, two controllers, and 32MB of RAM. The VARs and ISVs through which Amkly sells generally don't discount as aggressively as do computer dealers, but some discounts may be available. This is not the most machine you can get for your money, but if you want a compact unit with a reasonable expansion capacity, network-specific design features, and very available support, the Amkly 486/33E is a good choice.

BLACKSHIP COMPUTER SYSTEMS INC.

BLK 486/33 EISA

BY PATRICK HONAN Good expansion capabilities and solid performance on PC Magazine Labs' LAN benchmark tests indicate that Blackship Computer Systems' BLK 486/33 EISA is well equipped to handle network installations, small and large. But though Blackship delivers the machine at a low price, the company supplied only 330MB worth of storage—light for a 32-node network.

Priced at just $6,995, the tested machine came with 16MB of RAM, a 128K RAM cache, two 330MB hard disks, an EISA SCSI hard disk controller, two floppy disk drives, a Viewsonic 4E Super VGA monitor, and an Orchid ProDesigner II Super VGA board. This is probably a better setup for a desktop system than for a file server. Blackship sells Novell's *NetWare*, Version 3.11, for $4,895 but charges another $500 to install it—a service some manufacturers perform for free.

The BLK 486/33 EISA had an AMI motherboard that accepted up to 32MB of 70-nanosecond page-mode RAM via 4MB SIMMs. An additional 64MB of RAM on a proprietary 32-bit AMI memory board brings the system total to 96MB. You can expand the 128K RAM cache, which uses 15-ns. SRAM chips, to 256K.

The combination of the Maxtor hard disks and the AMI EISA SCSI controller made for competitive results on the benchmark tests. The controller came with a 4MB RAM cache, expandable to 16MB. Performance was better than average—though not out of normal range—on the tests.

The 24.4- by 7.5- by 17.9-inch (HWD) tower case puts the power switch, reset switch, and keyboard lock within easy reach along the front of the machine. The BLK 486/33's cover slides off easily, revealing eight drive bays: six standard-height 5.25-inch and two 3.5-inch. Four of the six 5.25-inch bays are accessible, an average number for tower cases.

Seven EISA slots and one 8-bit ISA slot govern expansion. The I/O board took up the ISA slot, while the video board and drive controller filled two EISAs, leaving

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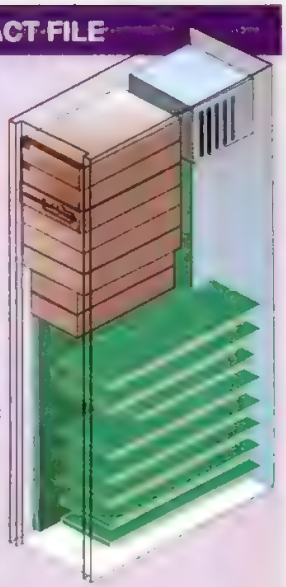

BLK 486/33 EISA
Blackship Computer Systems Inc., 2031 O'Toole Ave., San Jose, CA 95131; 800-531-7447, 408-432-7500.
List price (tested configuration): $6,995.
Memory and processor RAM cache: 16MB 70-ns. SIMMs, 128K cache.
Disk drives and controller: Two Maxtor 15-ms. 330MB SCSI hard disks, AMI controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0.
In Short: The BLK 486/33 EISA certainly fits the bill as a server in terms of storage capacity, with eight half-height drive bays and eight EISA slots. The price is competitive: $6,995 including 16MB of RAM, a 330MB hard disk, a 128K RAM cache, and Novell *NetWare*, Version 3.11. Blackship Computer Systems does not offer exceptional network support when it comes to options or support, however. The machine is not Novell certified.

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PC Magazine, Oct. 29, 1991

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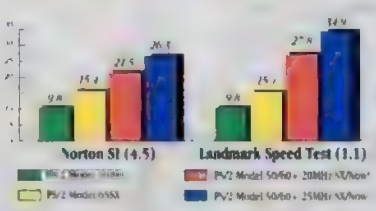

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one EISA slot free after we installed four NICs. A SCSI connector on the back of the controller lets you connect other devices, such as a CD-ROM player.

The BLK 486/33 EISA is not Novell certified, although Blackship is considering having the machine undergo Novell certification. On the test network, the reviewed unit performed without a hitch. Blackship's technicians are schooled in networking problems but do not specialize solely in networking support.

Blackship backs the BLK 486/33 EISA with a one-year parts-and-labor warranty and free on-site service from GE Computer Service during the first year. Extending the on-site service for a second year, for 20 percent of the system cost, simultaneously extends the warranty. Hours for the standard toll-free technical support are 7:30 to 5:30 weekdays, P.S.T.

Deciding on the BLK 486/33 EISA as a server depends on how much hand-holding and peace of mind you want. Blackship does not offer dedicated network support, and the machine itself is not Novell certified. Nevertheless, the system performed well and its price is reasonable. Remember to ask for more storage.

COMPAQ COMPUTER CORP.

Compaq Systempro/LT 486/33-510

BY JOHN R. QUAIN The younger, smaller brother of Compaq's multiprocessing EISA Systempro, the Systempro/LT 486/33-510 is not any smarter than its sibling. But those of modest means who envied other LAN managers' $34,000 Systempros may find that the Systempro/LT's $14,171 price puts a Compaq file server within reach. Others less concerned with the status and rigorous construction that Compaq represents, however, will find the Systempro/LT's poor test scores unimpressive.

The *LT* in this tower model's name means light, though it is not lightly constructed: Compaq's trademark heavy-duty chassis and parts have not been forsaken. Where the Systempro/LT departs from its predecessor is in power and storage. Unlike the original Systempro, which can handle two 486 CPUs and 256MB of RAM, the Systempro/LT harbors a single CPU, just 64MB of DRAM, and comes with a 510MB Conner IDE hard disk. That's still enough for a small LAN, however, and a match for most of the servers in this roundup.

If Compaq's optional Intelligent Drive Array (IDA) appeals to your desire for fault tolerance and greater storage, you better have deep pockets. The IDA controller alone, which comes with 128K of 20-nanosecond SRAM and manages up to four drive array pairs, costs $2,499. With that you will need at least one 1.02GB drive array pair—$7,999 more. The price is high, but it gives the Systempro/LT, which can hold four hard disk pairs, a considerable potential storage capacity of 4.08GB.

The EISA-bus Systempro/LT that Compaq sent us for testing was outfitted with a 33-MHz 486DX processor, 8MB of 80-ns. DRAM, a 510MB hard disk, a Wangtek 250MB tape backup unit, a 1.2MB and a 1.44MB floppy disk drive, a low-emission 14-inch Super VGA monitor, and DOS 5.0. The two floppy disk drives and the tape backup unit fill the three accessible drive bays, which are situated at a slight upward angle for easy access. A small sliding plastic cover over the power switch prevents accidental shutdown.

Compaq's trademark heavy-duty chassis and parts have not been forsaken.

The Compaq Systempro/LT we reviewed is the top of the LT line. (A 386/25 model sells for $3,600 less than the base-priced system; a 486SX/25 costs $1,800 less.) The Systempro/LT's CPU resides on a proprietary module. Memory starts with 8MB on the system board; you can increase this by using a proprietary memory card that comes standard with the PC. There is no external SRAM cache. The system board does not offer the full modularity of the company's latest Compaq Deskpro/M line, but using the CPU and memory modules does make future upgrades easier.

In addition to the two proprietary slots for CPU and memory, the motherboard has eight EISA slots, two of which were free after we inserted four NICs. The motherboard offers a substantial amount of integration. Where other machines rely on add-in cards, Compaq uses a few chips. A parallel, two serial, and one mouse port are on the system board. The IDE controller is integrated into the system board, and by running all power connections directly into the motherboard, the interior remains remarkably unobstructed.

Compaq includes an EISA Super VGA video adapter with the system. Also part of the package is *Sytos Plus* file-backup software for the tape drive and a configuration utility that automatically detects and configures EISA boards. (It will also help determine the necessary switch and jumper settings for ISA boards.)

Setting up the Systempro/LT for a *NetWare* network proved trouble-free, even though Novell certification was pending at the time of testing. Although the Systempro/LT was intended for midsize networks that have 5 to 30 users, we applied a load of 32 users. On the server utiliza-

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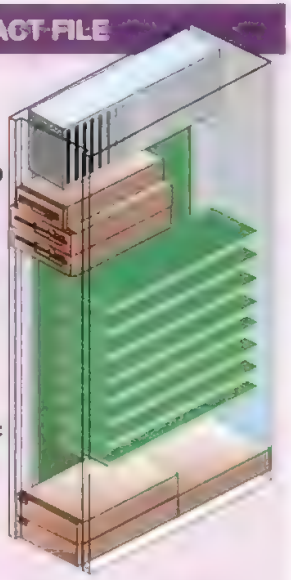

Compaq Systempro/LT 486/33-510 Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-231-0900, 713-370-0670.
List price (tested configuration): $14,171.
Memory and processor RAM cache: 8MB 80-ns. DIPs and SIMMs
Disk drives and controller: Conner 12-ms. 510MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Compaq Super VGA adapter with 512K RAM, Compaq 14-inch monitor.
Monitor refresh rate: 62.8 Hz.
Software: DOS 5.0.
In Short: Compaq has not skimped an ounce on its Compaq Systempro/LT 486/33-510's construction. For $14,171, you get a file server impervious to dropkicks and earthquakes. Unfortunately, you won't get astounding throughput or storage. Most of the servers in this roundup offered more storage and memory while beating this unit on nearly every LAN speed test.

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tion test, however, the Systempro/LT turned in the second-poorest score, with a score of 72 percent when the average for the group overall was about 60 percent (lower scores indicate better performance).

Where the Systempro/LT also dropped significantly behind the rest of the server pack was on the Directory Access Throughput test. Along with the IBM PS/2 Model 95 XP 486 and Tri-Star Flash Cache 486E, the Systempro/LT was consistently one of the bottom three performers. On the Hard Disk Access Load test, the Systempro/LT turned in the second-lowest score, indicating that its ISA IDE controller and memory arrangement were simply unable to match the performance of the competing cached ESDI and SCSI controllers.

Of interest to those planning to use their purchase as a database server, the Directory Access Throughput test also placed the Systempro/LT with the bottom three. The server's lack of an external RAM cache and only 8MB of memory may have hampered the CPU and memory connection here.

With enough reinforced metal to withstand nearly any physical hardship, the Compaq Systempro/LT 486/33-510 is an undeniably well-built machine, clean and well-ventilated throughout. But the reliable construction and attention to detail come at a steep price—even with the usual 30 percent dealer discount. And these days, most vendors can put together enough quality off-the-shelf parts to meet or surpass the performance needs of midsize networks.

COMPUADD CORP.

CompuAdd 433E

BY BRUCE BROWN You shouldn't judge a server only by how easy it is to set up and configure; the key to choosing the right server depends on the PC's component configuration. To this end, the CompuAdd 433E's full-size tower box has good RAM expansion capacity, eight bus-mastering EISA interface slots, and a better-than-average complement of disk drive bays. Though the CompuAdd 433E is less expensive than many systems, stuffing this box with drives and memory can make the price climb dramatically.

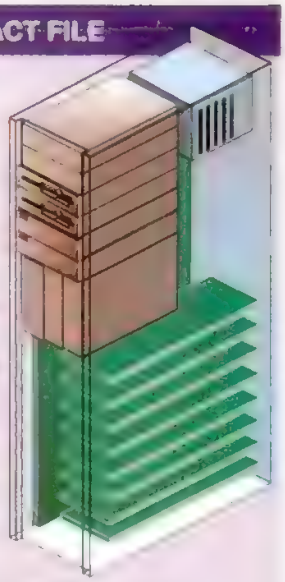
Our test machine was not heavily equipped. The $6,324 system included 8MB of RAM, a 256K RAM cache, a 338MB 14-millisecond Seagate SCSI hard disk, a noncached BusTek EISA bus-mastering disk controller, a 1.2MB and a 1.44MB floppy disk drive, and a Super VGA color video subsystem.

CompuAdd sells tape drives, but Novell recommends putting a tape drive in a workstation rather than in the server, where the drive would be accessible in case of a server breakdown. CompuAdd sells *NetWare*, Version 3.11, at prices that depend on the number of users (the 20-user price, for example, is $2,450).

You can expand the RAM on the CompuAdd-made motherboard to a 64MB system maximum by using 4MB 80-nanosecond DRAM SIMMs. The two-way set-associative write-back RAM cache, a $999 option, uses 17-ns. SRAMs and expands to 256K. The motherboard also holds a CompuAdd version of the Phoenix ROM BIOS, which is socket-upgradable, and a socket for a Weitek 4167 math coprocessor.

Nine half-height drive bays, four of which use removable media, can accept 5.25-inch storage devices. And thanks to the ten device leads on the CompuAdd's 300-watt power supply, you can plug in everything without resorting to power splitters.

FACT FILE



CompuAdd 433E
CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; 800-456-3116, 512-250-1489.
List price (tested configuration): $6,324.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 14-ms. 338MB SCSI hard disk, BusTek controller, 1.2MB and 1.44MB floppy disk drives.
Display: CompuAdd Super VGA adapter with 1MB RAM, CompuAdd 14-inch monitor.
Monitor refresh rate: 60 Hz
Software: DOS 5.0.
In Short: The CompuAdd 433E tower-case EISA-bus system lets you install up to 64MB of RAM and nine drives. The conservatively configured test system's relatively low price would be closer to the other system prices in this roundup if you boosted the memory to 16MB and the hard disk storage to 1GB. This is a fine computer to use as a server, but it has no outstanding characteristics.

CIRCLE 500 ON READER SERVICE CARD

Six of the eight EISA slots were filled, four with the NICs, one with the BusTek hard disk controller, and the other with CompuAdd's 1MB HiRez video adapter. In fact, the tested system had more video than you will probably need for a server: The CompuAdd HiRez video adapter, capable of 1,024-by-768 noninterlaced resolution, was matched with a 14-inch color Super VGA monitor that had a 60-Hz vertical refresh rate at an 800-by-600 noninterlaced resolution.

Except for a single Novell General Exception SCSI parity error, which occurred only when we first attached the CompuAdd to the network rings, we encountered no Novell compatibility or performance problems. CompuAdd Corp. is currently applying for Novell certification for this PC and expects to have it by the time this review is published.

CompuAdd sells systems via mail order and through its 120 retail stores. A one-year parts-and-labor warranty, with extensions available for a price based on the system configuration, comes standard.

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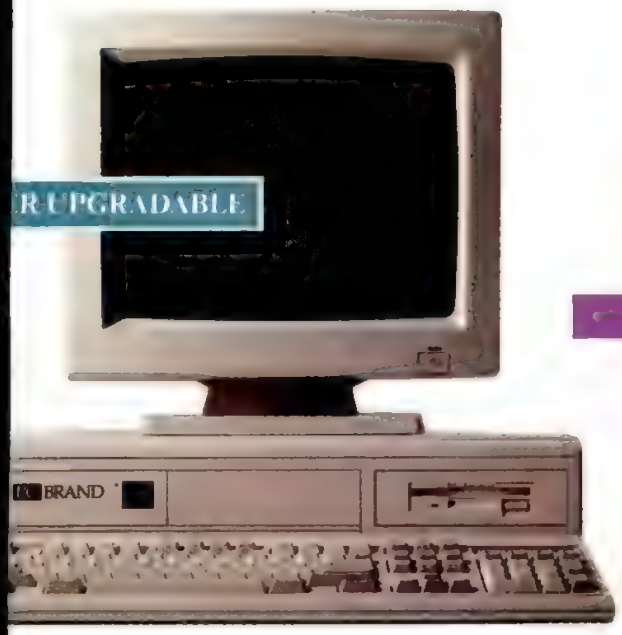

486/33 SYSTEM

$2,695

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• Intel 80486, 33MHz Processor • 4MB RAM expandable to 32MB • 1.44MB, 3.5" drive • 1.2MB, 5.25" drive • 200MB IDE, 18ms hard drive • 16-bit VGA with 1MB • Super VGA color monitor (1024 x 768 resolution) • 1 parallel port/2 serial ports • 101-key enhanced keyboard • Serial mouse • MS DOS 5 • MS Windows 3.0

386/SX-25 NOTEBOOK

$1,995

Lease: $80/month

• 80386SX, 25MHz Processor • 2MB RAM expandable to 16MB • 1.44MB, 3.5" drive • 80MB IDE, 19ms hard drive • Paper white VGA, non-glare CCFT backlit LCD • 640 x 480 resolution, 32 gray shades • Supports an external VGA • 1 parallel port/2 serial ports • External keyboard port • MS DOS 5 • Leather carrying case • 8.66" x 11" x 2.08", 6.5 lb.

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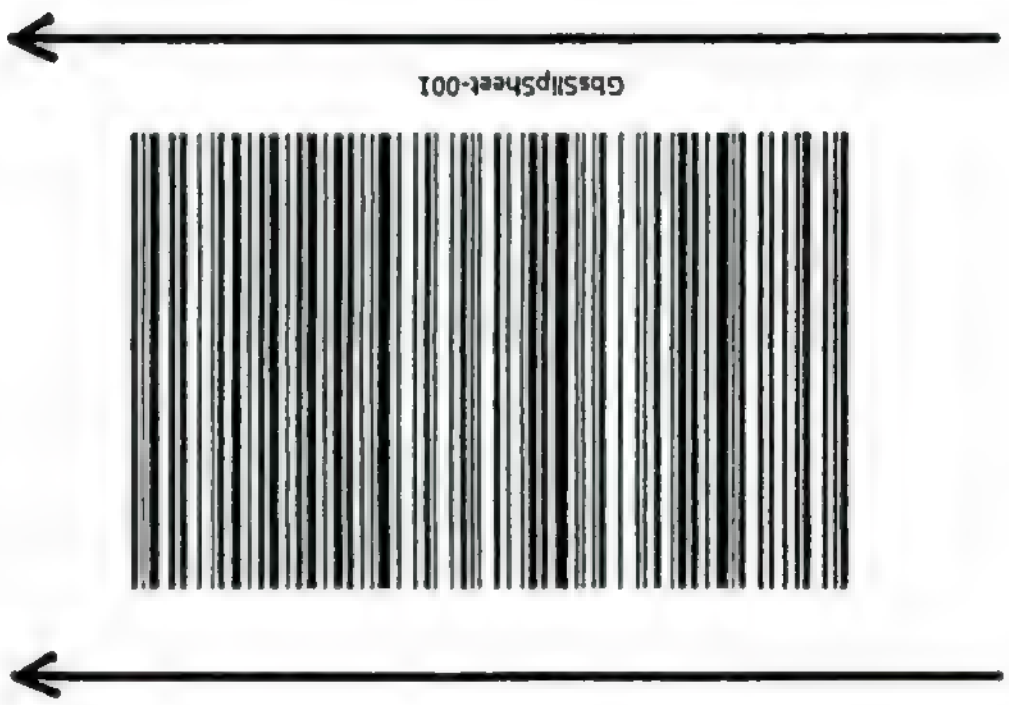

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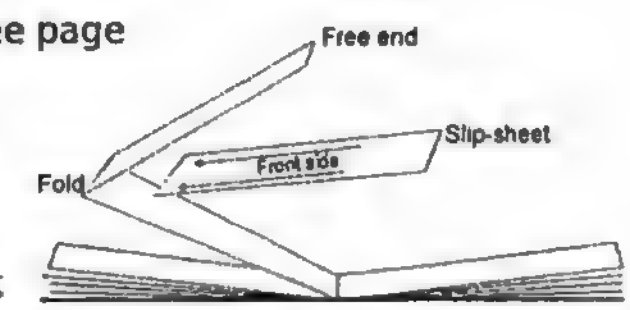

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386/SX-25 SYSTEM

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486/SX-20 SYSTEM

$1,995

Lease: $80/month

• Intel 80486SX, 20MHz Processor • 4MB RAM expandable to 32MB • 1.44MB, 3.5" drive • 1.2MB, 5.25" drive • 100MB IDE, 18ms hard drive • 16-bit VGA, 512K • Super VGA color monitor (1024 x 768 resolution) • 1 parallel port/2 serial ports • 101-key enhanced keyboard • Serial mouse • MS DOS 5 • MS Windows 3.0

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- 1.2MB, 5.25" drive
- 100MB IDE, 18ms hard drive
- 16-bit VGA, 512K
- Super VGA color monitor (1024 x 768 resolution)
- 1 parallel port/2 serial ports
- 101-key enhanced keyboard
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- 4MB RAM expandable to 32MB
- 1.44MB, 3.5" drive
- 1.2MB, 5.25" drive
- 100MB IDE, 18ms hard drive
- 16-bit VGA, 512K
- Super VGA color monitor (1024 x 768 resolution)
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- 200MB IDE, 18ms hard drive
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386/SX-25 NOTEBOOK

- 80386SX, 25MHz Processor
- 2MB RAM expandable to 16MB
- 1.44MB, 3.5" drive
- 80MB IDE, 19ms hard drive*
- Paper white VGA, non-glare CCFT backlit LCD
- 640 x 480 resolution, 32 gray shades
- Supports an external VGA
- 1 parallel port/2 serial ports
- External keyboard port
- MS DOS 5
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- 1.2MB, 5.25" drive
- 100MB IDE, 18ms hard drive
- 16-bit VGA, 512K
- Super VGA color monitor (1024 x 768 resolution)
- 1 parallel port/2 serial ports
- 101-key enhanced keyboard
- Serial mouse
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- 1.44MB, 3.5" drive
- 1.2MB, 5.25" drive
- 200MB IDE, 18ms hard drive
- 16-bit VGA with 1MB
- Super VGA color monitor (1024 x 768 resolution)
- 1 parallel port/2 serial ports
- 101-key enhanced keyboard
- Serial mouse
- MS DOS 5
- MS Windows 3.0
- User Upgradable

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486/33 EISA CACHE SYSTEM

- Intel 80486, 33MHz Processor
- External zero-wait state
- 64KB static RAM cache
- 8MB RAM expandable to 64MB
- 1.44MB, 3.5" drive
- 1.2MB, 5.25" drive
- 200MB IDE, 18ms hard drive
- 16-bit VGA with 1MB
- Super VGA color monitor (1024 x 768 resolution)
- 1 parallel port/2 serial ports
- 101-key enhanced keyboard
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Memorex Telex, which has more than 200 locations nationwide, supplies free on-site service for the first year; the rate afterward is figured on a percentage of the price. CompuAdd makes network-specific support available as part of its regular technical support, which can be reached via an 800 number Monday through Friday, 8:00 to 7:00 C.S.T. You can also return the system to authorized CompuAdd service centers, which are located in the company's retail stores.

There are no surprises here, either good or bad. The CompuAdd 433E looks and acts like a typical server, and its price is reasonable. The wide variety of extra memory, cards, and drives is this server's strongest suit.

DELL COMPUTER CORP.

Dell PowerLine 433DE

BY KELLYN BETTS Dell Computer Corp.'s painstaking research into *NetWare*'s idiosyncrasies has yielded a network server with excellent performance—and the technical expertise to support it.

For testing, the company sent us its Dell PowerLine 433DE configured with 32MB of RAM, 128K of RAM cache, and two 14-millisecond 330MB Micropolis hard disks controlled by a cached UltraStor controller. That system, which also included one floppy disk drive, integrated video, an 800-by-600 monitor, and DOS 5.0, costs $11,388.

Housed in a desktop chassis with limited mass-storage subsystem space, this PowerLine model does not represent Dell's vision of an ideal server. But it is very similar electronically to the system Dell would recommend for the job, the tower-encased PowerLine 433SE, which would cost $14,388 for an identical configuration. The slim-line case of the tested PowerLine 433DE had no room for the Wangtek tape backup unit that Dell would have fit into one of the PowerLine 433SE's three exposed bays; also, the tape backup unit would have added $1,299 to the PowerLine 433DE's price. Both systems are Novell certified.

Though Dell did not recommend the PowerLine 433DE for server use, we were able to test its merits in the role. Its high level of integration left enough space for the four network cards we needed to install for testing. And the PowerLine 433DE managed to pump data through these cards consistently faster than any other server we reviewed, with only a few exceptions when we attached 8, 16, 24, and 31 nodes. The only test on which the PowerLine 433DE didn't perform at the top of the class was the server utilization test.

Dell's explanation for why its system excelled under *NetWare* is elaborate. For 32 users, a Dell spokesperson explained, either 16MB or 32MB of RAM is appropriate in terms of price and performance. The company sent us a system with 32MB in 80-nanosecond SIMMs, having decided that the speed edge the extra RAM gave was worth its $1,599 cost. Because the *NetWare* file system is so cache-oriented, it benefits from fast processor-to-memory performance. The 128K of 30-ns. write-through SRAM cache contributes by storing the most-recently-used data so that subsequent accesses to it are much faster. The two-way interleaved page-mode arrangement of the DRAM allows faster sequential accesses.

Dell recommends its PowerLine 433SE, not the desktop model we tested, as a server.

The PowerLine 433DE's hard disk arrangement also contributed to its stellar performance. Though our testing scheme disallowed the drive arrays that the PowerLine 433SE supports, Dell nonetheless took advantage of the benefits of using multiple hard disks instead of a single large one by sending us two 349MB units. Under the direction of an ESDI UltraStor 22C bus-mastering controller with 4MB of cache, we configured the hard disks so that the data recorded on them was spanned. Like the two-way set-associative architecture of the RAM cache, drive spanning allows the hard disks to function collaboratively so that one can be seeking data while the other is refreshing it.

The PowerLine 433DE is technologically advanced, yet our technicians found it easy to set up. Dell's computers always come with thorough, carefully detailed manuals that supply advice and informa-

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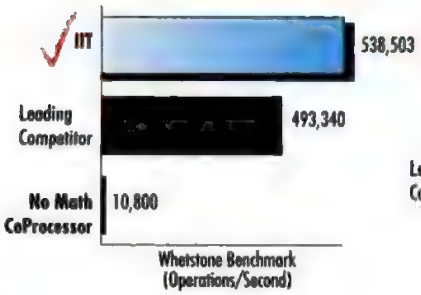

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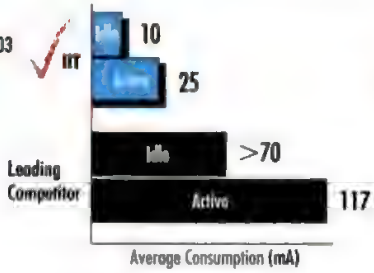

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Test results obtained on a 20 MHz 386SX system.

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CIRCLE 192 ON READER SERVICE CARD

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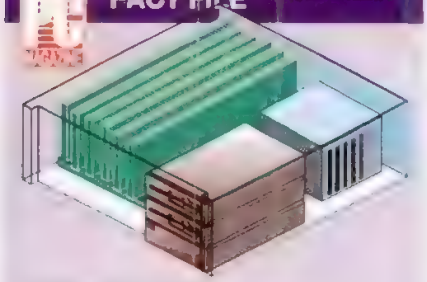

Dell PowerLine 433DE
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-426-5150, 512-338-4400.
List price (tested configuration): $11,388.
Memory and processor RAM cache: 32MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Two Micropolis 14-ms. 330MB ESDI hard disks, UltraStor controller with 4MB cache, 1.2MB floppy disk drive.
Display: Dell Super VGA adapter with 512K RAM, Samsung 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: If it had more expansion room, the Dell PowerLine 433DE would make a fine server. Setup was a cinch, the manuals were clear and detailed, and the system performed well on PC Labs' LAN benchmark tests. Examine Dell's tower unit, the PowerLine 433SE, for the right storage and expansion capabilities.

CIRCLE 501 ON READER SERVICE CARD

tion about every conceivable problem and component. The company also offers excellent technical support through an 800 line, as well as a one-year parts-and-labor warranty backed up by on-sight service from Xerox.

Though we were unable to test a Dell 433SE, we have every reason to believe that this model would perform just as well as the PowerLine 433DE, if not better. The Dell-made motherboard in the PowerLine 433SE is superior to the one in its desktop counterpart. Though both contain the same Dell chip set and are powered by the same card-based 486/33 processor, the 433SE's motherboard has eight EISA slots to the 433DE's six. Unlike the PowerLine 433DE, not all of the PowerLine 433SE's slots are bus-mastering: Two are bus slaves. The PowerLine 433SE's six bus-mastering slots, however, are enough to support the four NICs and the EISA controller, all of which are bus-mastering.

The PowerLine 433SE motherboard also has a better integrated VGA chip set: Instead of the older Western Digital 9C11 found on the PowerLine 433DE's motherboard, the Dell PowerLine 433SE has a Tseng 4000 chip set. Both chip sets allow the motherboard-integrated video controller to display up to 1,024-by-768 resolution, though few server users will need it. Four ports plus IDE hard disk support are integrated onto both machines' motherboards.

The most important difference between the PowerLine 433DE and the PowerLine 433SE is in the amount of mass-storage space they offer. The tower-encased PowerLine 433SE boasts a whopping 11 half-height drive bays, three of which are exposed. The PowerLine 433DE's complement of only four bays is what makes it inappropriate for use as a server.

The PowerLine 433DE's price seems relatively low compared with those of the other systems reviewed in this issue, but it is unfair to use this PC as a point of comparison. The PowerLine 433SE that we should have reviewed costs a far-more-sizable $15,687; the seven bays' worth of mass-storage space and the tape drive that the extra dollars buy are absolutely necessary for a server. Still, our tests and experiences indicate that the PowerLine 433SE is probably well worth the premium price.

EVEREX SYSTEMS INC.

Everex STEP Megacube

The pricey Everex STEP Megacube is high powered and highly expandable.

BY BRUCE BROWN High powered and highly expandable, the Everex STEP Megacube is not a cheap computer, especially since the evaluation unit Everex Systems sent us has somewhat limited storage. At $12,795, it has 16MB of 80-nanosecond RAM, a 256K RAM cache, a 337MB 12-millisecond Seagate SCSI hard disk with a non-cached Adaptec disk controller, a 1.2MB floppy disk drive, and a color Super VGA display subsystem. Everex sells through dealers, so discounts are likely, but this PC will still be expensive even if you find it at a 20 to 25 percent discount.

A vertical door on the case front covers the power switch and the front of the four accessible 5.25-inch half-height drive bays. Locks on the back of the case control access to each of the removable side covers—one for the drive bays and the other for the expansion slots.

Besides the four accessible half-height drive bays, the Megacube has room for two full-height or four half-height 5.25-inch drives. Since the 400-watt power supply has only seven device power leads, you will need power splitters if you want a fully loaded system using only half-height drives. But if you prefer huge-capacity full-height internal hard disks and reserve the four accessible bays for removable media, the number of power leads is exactly what you need.

Everex has provided a variable-speed, thermistor-controlled cooling fan on each side of the case. With ample space inside, heat buildup should not be a problem.

Twelve slots line the Everex motherboard. One holds the proprietary memory board that carries all the system RAM, which you can boost to 64MB using 4MB page-mode interleaved SIMMs. A stan-

7 NOTEBOOK USERS WERE LOCKED IN A ROOM. LESS THAN 4 HOURS LATER, 6 OF THEM WERE DEAD.

OK, we didn't really lock anybody up. But an independent laboratory did run *PC Magazine's* Battery Rundown Test on 7 leading notebook computers. And we're happy to report that Dell came in dead last.

In fact, Dell's power management system and NiMH battery helped the 320N+ run a full 30 minutes longer than the nearest competitor. More than enough to get you through the next marathon meeting or epic plane flight.

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Dell 320N+	**4:00 Hours**
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Compaq LTE 386s/20	*3:05 Hours*
TI Travelmate 3000	*2:32 Hours*
Zenith MastersPort 386SL	*2:26 Hours*
AST Premium Exec	*2:08 Hours*
IBM PS/2 Model L40SX	*1:55 Hours*

Test in accordance with PC Magazine's testing parameters.

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Dell 320N+ 4 MB RAM and 60 MB Disk Drive	**$2,999**
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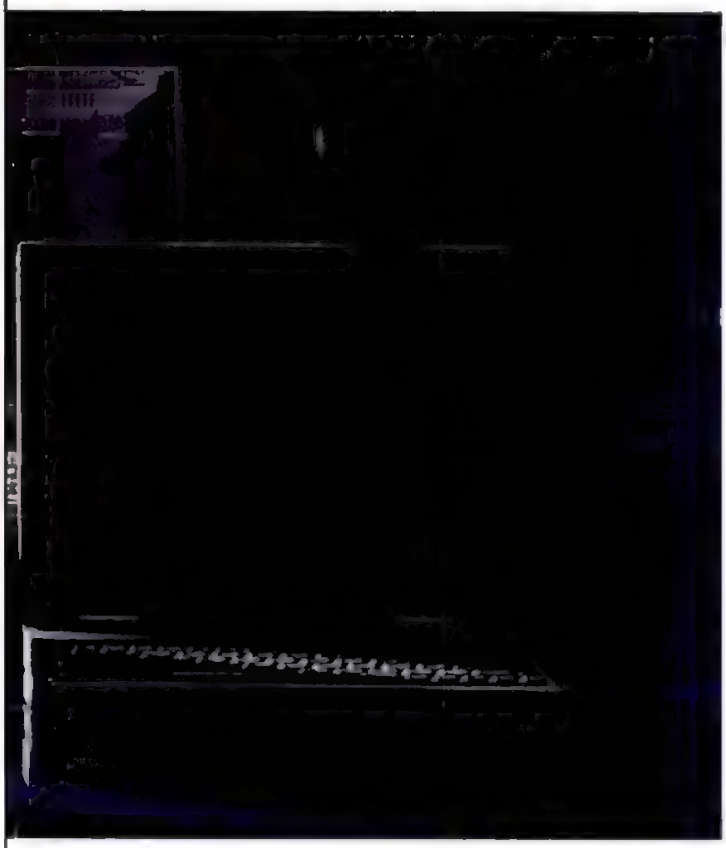
Compaq LTE 386s/20—4 MB RAM and 60 MB Disk Drive	$4,297†
TI Travelmate 3000—4 MB RAM and 60 MB Disk Drive	$3,498
Zenith MastersPort 386SL—4 MB RAM and 60 MB Disk Drive	$4,898
AST Premium Exec.—4 MB RAM and 80 MB Disk Drive	$3,295*
IBM PS/2 Model L40SX—4 MB RAM and 60 MB Disk Drive	$4,134

**4 MB and 60 MB Disk Drive retails for $400 more. Go figure.*

Actual dealer prices may vary.

intel inside

†Source: Compaq Computer Press Release 11/4/91. All other suggested retail prices as of 1/16/92. All prices and specifications are subject to change without notice. **Payment based on 36-month, open-end lease ◊ Leasing arranged by Leasing Group, Inc. In Canada and Mexico, configurations and prices may vary. Dell is a registered trademark and TechFax is a service mark of



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CIRCLE 029 ON READER SERVICE CARD

dard floppy disk controller filled the single 8-bit ISA slot, while network-interface, video, and hard-disk controller cards took up six of the remaining EISA slots, leaving four unfilled slots.

We encountered a couple of false starts when we tested the Megacube. The first system Everex sent us experienced several problems: it dropped one of our four network rings and registered a Novell processor exception error. A replacement unit at first experienced random video errors but eventually settled down and ran just fine, yielding benchmark test scores within the normal range. Since the Megacube is Novell certified, once you configure and set it up properly, all should be well.

The Everex Megacube offers design features for system protection that go beyond the norm.

You can extend the standard one-year warranty, which includes on-site service; the price depends on the system configuration. National Computer Systems, which has more than 100 locations nationwide, does the on-site service. Toll-call technical support is available Monday through Friday, 5:00 to 5:00 P.S.T.

You pay a fair penny for this system, but the Everex STEP Megacube gives you

SUMMARY OF FEATURES

List price (*PC Magazine* configuration) For this review of file servers, we asked each vendor to configure an EISA or MCA 486/33 PC to meet the needs of a 32-node network. Each vendor could fill its PC with as much or as little componentry as desired—any amount of RAM, cache, and storage—and could send either color or monochrome video.

The price of the *PC Magazine* configuration is followed by its **hard disk capacity.** Unless otherwise noted, all table entries refer to the range of options available in the systems reviewed.

Distribution channel Some machines are sold directly through mail order, others through dealers. Dealers have previously offered discounts of 25 percent or more off the list price; however, an industry-wide price restructuring has cut these discounts in many cases. *PC Magazine* views a 15 percent discount as typical.

Bus architecture The original IBM PC AT bus used the 16-bit Industry Standard Architecture (ISA). Extended Industry Standard Architecture (EISA) and Micro Channel architecture (MCA) allow 32-bit transfers.

Chip set manufacturer indicates which company makes the logic that connects the CPU with the other functions managed by the system board. Chip sets that use VLSI (very large-scale integration) technology reduce the discrete component count, which in turn helps reduce power consumption and increase component life.

System shadowing/Video shadowing Shadow RAM is a technology that loads system BIOS or video BIOS from slower ROM into faster RAM on boot-up, offering enhanced performance speed. Shadowing uses RAM located between 640K and 1MB.

The **BIOS** version **(or date)** can affect PC Magazine Labs' benchmark test results. Those purchasing the same-model machine with a different BIOS version may encounter some variations in performance.

Flash memory contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Maximum number of processors supported We indicate how many processors can be installed, since some file servers may have multiprocessing capabilities.

Installable RAM indicates the minimum and maximum amount of memory that can be installed using any combination of chips and proprietary cards.

Front-accessible drive bays can be reached from the system's front panel and can support removable media (such as tape and CD-ROMs); **internal drive bays** can be reached only by opening the case. We report the maximum number of accessible and internal drives the system can hold.

Minimal floppy disk drive configuration indicates whether the vendor equips its base-priced system with a 1.2MB floppy disk drive, a 1.44MB floppy disk drive, or both.

Hard disk options We report the range of hard disk capacities the vendor offers.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated into the drive and motherboard.

Drive array available We report whether the vendor sells an internal or external disk array—a group of hard disks that are specially configured to work as one unit, providing redundancy and fault tolerance. Similarly, we report if the company sells a **tape backup** unit.

Expansion bus For each type of expansion slot—8-bit, 16-bit, 32-bit EISA MCA, and 32-bit proprietary - we report the number of slots on the motherboard and the number of slots left open when the unit is equipped in our *PC Magazine* configuration.

Tested display mode refers to the resolution of the video card that came in the tested configuration. For this review, we requested a Super VGA display (800 by 600 pixels), though we accepted 1,024-by-768 resolution as well.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled there is no way to upgrade it.

Number of device connectors indicates how many internal storage devices the power supply can support without requiring Y cables (power splitters).

***NetWare*, Version 3.11** When *NetWare* is available from the same vendor, we indicate the suggested list price for this network operating system.

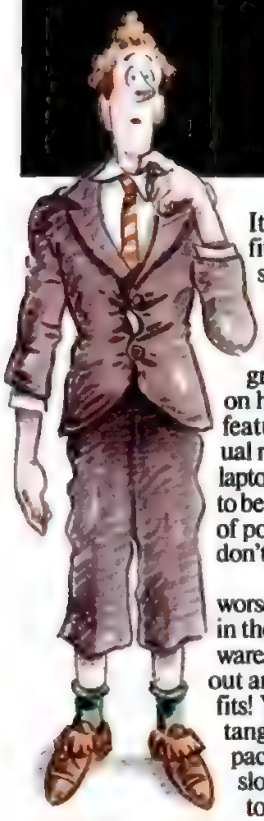
Other operating systems supported We indicate whether the system supports OS/2 or Unix, as well as network operating systems such as Banyan Systems' *VINES*.

First year on-site service charge This charge may be included in the price of the system, or it may be a set or variable amount. If the charge varies, it is often determined by the system's configuration and cost.

Novell certification A system that carries this certification has passed Novell's *NetWare*-suitability tests. Certification is not mandatory, but it does provide an extra measure of assurance.

CONTINUES

Why So Many Communications Users Can't Fit Into Their Software.



It seems like no one fits into their comm software anymore. Your company's power users can't squeeze into programs that scrimp on high-performance features. Yet, your casual modem users and laptop users can't afford to be swamped by scores of power features they don't need.

To make matters worse, if everyone brings in their own comm software, PC anarchy breaks out and then nothing fits! You're left with a tangle of incompatible packages from the sloppiest shareware to the most sophisticated software. You can't share scripts. Can't share support and training. Can't easily share much of anything!

What you *can* do is take a closer look at the Crosstalk® family of products.

Crossing The Communications Gap.

Crosstalk Mk.4 and Crosstalk Communicator not only let you fit the right software to the right users, but both comm programs actually work as a team. Since the two programs share the same code base and menu system, users can easily move from one to the other. Training and support are simplified. And complex scripts can be written on one, yet run on the other.

With both packages, you get the engineering excellence for which Crosstalk is famous–and the kind of support and back-up that only come from a company like DCA®.

> *"If you develop scripts in Mk.4 but your coworker prefers the easier-to-use Crosstalk Communicator, that's fine. You can use the same scripts with Communicator."*
> *–PC Magazine*

The Most Fitting Solutions.

Crosstalk Mk.4 is the ultimate comm software for power users. When the editors of *PC Magazine* chose it as the top performer among all comm packages for 1991, they called it, "A top-notch program that does almost everything and does it all right..." It has the CASL™ scripting language (a powerful programming language like C or Pascal) for automating communications. Plus, highly specialized capabilities from VT™ emulators and ZMODEM to FTTERM and IND$FILE. Data transmission rates up to 115,200bps. Multiple sessions. And modem sharing on LANs.

Crosstalk Communicator is the favorite of executives and laptop users.

It's simple enough to configure and begin communicating in three minutes, yet includes so many of the same popular features as Crosstalk Mk.4 that *InfoWorld* called it "an exceptional value...anything but stripped down."

Individually, Crosstalk Mk.4 and Communicator perform so well that *PCWorld* gave both products the "Best Buy" award in their respective categories.

CIRCLE 278 ON READER SERVICE CARD

Together, they provide an unbeatable solution that can be tailor-made to your users and budget.

Avoid Nightmares Like The Great Crash Of '91.

Get your free reprint of PC Magazine's comm software round-up (incl. tests on communications over high-speed modems). Call 1-800-348-DCA-1, ext. 84A.

Some say it's worth specifying Crosstalk for the reliability alone. Remember April of '91 and the popular comm package that crashed repeatedly when *PC Magazine* attempted high-speed file transfers? Crosstalk was the benchmark for those very same tests.

So, if you're looking for the most reliable, fitting solution for *all* your comm users, look into Crosstalk. We'll send a free booklet to help you match the right Crosstalk programs to your particular needs.

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CROSSTALK

Another Communications Solution From DCA

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April 1991 Crosstalk Communicator — April 1991 Crosstalk Mk.4 — April 30, 1991 Crosstalk Mk.4 Version 2.0 — Software Digest ★★★★ Vol. 7 No. 12, 1990 Crosstalk Mk.4

SUMMARY OF FEATURES

Products listed in alphabetical order by company

—Editors' Choice
■—Yes ❑—No

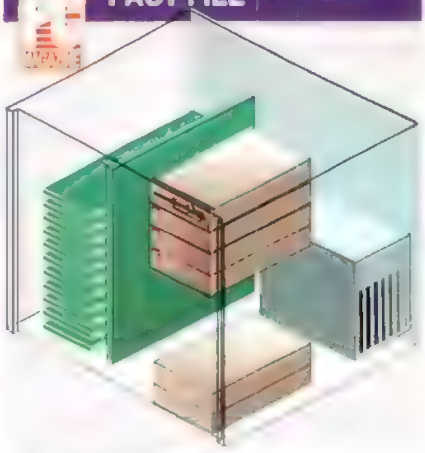
	ALR PowerPro VM 486/33	Amkly 486/33E	BLK 486/33 EISA	Compaq Systempro/LT 486/33-510	CompuAdd 433E
List price (*PC Magazine* configuration)	$11,527	$9,945	$6,995	$14,171	$6,324
Hard disk capacity	400MB	984MB	660MB	510MB	338MB
Distribution channel	Dealers	Dealers	Direct	Dealers	Dealers, direct
Case style	Tower	Small-footprint	Tower	Tower	Tower
Bus architecture	EISA	EISA	EISA	EISA	EISA
MOTHERBOARD					
Motherboard manufacturer	ALR	Amkly	AMI	Compaq	CompuAdd
Chip set manufacturer	Intel	Intel	Discrete logic	Compaq	Intel
System shadowing/Video shadowing	■/■	■/■	■/■	■/■	■/■
BIOS version (or date)	Phoenix 1.00.10A	Amkly/Phoenix 1.00.02	AMI EISA II	Compaq 08.14.91	Phoenix/CompuAdd 1.01
Flash memory	❑	■	❑	❑	❑
Supports 80487/Weitek coprocessor	■/■	❑/■	■/■	❑/❑	❑/■
Maximum number of processors supported	2	1	1	1	1
MEMORY AND PROCESSOR RAM CACHE					
Installable RAM	1MB–305MB	2MB–64MB	1MB–96MB	8MB–64MB	1MB–64MB
Cache controller	ALR	N/A	Discrete logic	N/A	Discrete logic
Installable RAM cache	64K–256K	N/A	128K–256K	N/A	256K
Cache architecture and write policy	Direct-mapped, write-back	N/A	Direct-mapped, write-through	N/A	Two-way set-associative, write-back
DISK DRIVES					
Front-accessible drive bays	Four 5.25-inch, no 3.5-inch	Two 5.25-inch, one 3.5-inch	Four 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch
Internal drive bays	1	1	4	8	5
Minimal floppy disk drive configuration	1.2MB	1.2MB	1.2MB, 1.44MB	1.2MB or 1.44MB	1.2MB
Hard disk options	150MB–650MB	120MB–1GB	200MB–1.4GB	120MB–4.08GB	80MB–1.2GB
Disk controller location	Card	Card	Card	Integrated	Card
Drive array available	❑	❑	❑	■	❑
Tape backup available	None	None	Colorado Memory Systems ($375)	Compaq ($1,999)	Archive ($829)
EXPANSION BUS					
8-bit slots	None	None	None	None	None
16-bit slots	2 (1 open)	None	None	None	None
32-bit EISA/MCA slots	8 (7 open)	6 (4 open)	7 (5 open)	8 (6 open)	8 (6 open)
32-bit proprietary slots	2 (none open)	1 (none open)	1 (open)	2 (none open)	None
Parallel, serial, mouse ports on motherboard	1, 2, 1	1, 2, 1	None	1, 2, 1	1, 2, 0
VIDEO					
Tested display mode	Super VGA	VGA	Super VGA	Enhanced VGA	VGA
Display circuitry location	Card	Motherboard	Card	Card	Card
Video chip set manufacturer	Western Digital	Trident	Tseng	Compaq	Tseng
POWER SUPPLY					
Power supply (watts)	300	200	250	355	300
Number of device connectors	4	4	4	7	10
SOFTWARE					
DOS	5.0	5.0	5.0	5.0	5.0
NetWare, Version 3.11	Not available	Not available	$5,195	Not available	$2,450
Other operating systems supported	OS/2, Unix, *VINES*	OS/2, Unix	OS/2, Unix	*NetWare*, OS/2, Unix, *VINES*	OS/2, Unix
MISCELLANEOUS					
Warranty	1 year	1 year	1 year	1 year	1 year
First year on-site service charge	Percentage of system cost	Included	Included	Depends on dealer	Included
Novell certification	■	Pending	❑	Pending	Pending

N/A—Not applicable: The product does not have this feature.
AIR—Advanced Integration Research, ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., ETEQ—ETEQ Microsystems Inc.

Dell PowerLine 433DE	Everex STEP MegaCube	Gateway 486-33 EISA	Hertz 486/33Ei	IBM PS/2 Model 95 XP 486
$11,388	$12,975	$6,295	$14,885	$25,455
660MB	337MB	1GB	2GB	1.6GB
Direct	Dealers	Direct	Dealers, direct	Dealers
Desktop	Cube	Desktop	Tower	Tower
EISA	EISA	EISA	EISA	MCA
Dell	Everex	Enigma	Intel	IBM
Dell	Intel	Intel	Intel	IBM
■/■	■/■	❑/■	■/■	■/■
Phoenix 1.00	AMI (August 1991)	Award 4.26A	Phoenix 1.10.33.K1	IBM 1.02
AOS				
■	❑	■	❑	❑
❑/■	❑/■	❑/■	■/■	❑/❑
1	1	1	1	1
4MB–96MB	1MB–64MB	8MB–64MB	1MB–64MB	4MB–64MB
Austek	Discrete logic	Intel	Intel	IBM
128K	256K	128K–256K	128K	256K
Two-way set-associative, write-through	Direct-mapped, write-back	Direct-mapped, write-through	Look-through, write-through	Two-way set-associative, write-through
Three 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch	Five 5.25-inch, no 3.5-inch
2	4	2	4	2
1.2MB	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
80MB–1.4GB	40MB–1GB	40MB–1.2GB	380MB–2GB	80MB–400MB
Card	Card	Card	Card	Card
■	❑	❑	❑	❑
Wangtek ($1,299)	Excel ($359)	Archive ($295)	Wangtek ($895)	IBM ($765)
None	1 (none open)	None	None	None
None	None	None	None	None
6 (5 open)	10 (8 open)	8 (4 open)	10 (8 open)	8 (5 open)
1 (none open)	1 (none open)	None	None	1 (none open)
1, 2, 1	1, 2, 0	0, 1, 0	2, 2, 1	1, 1, 1
VGA	Super VGA	1,024 x 768	Super VGA	XGA
Motherboard	Card	Card	Card	Card
Western Digital	Everex	Tseng	Tseng	IBM
224	400	200	396	329
6	7	4	8	3
5.0	5.0	5.0	5.0	5.0
$2,520	$3,495	Not available	$6,995	$7,055
OS/2, Unix, Xenix	OS/2, Unix	OS/2, Unix, Xenix	OS/2, Unix	OS/2, *VINES*
1 year	1 year	1 year	1 year	1 year limited
Included	Included	Included	$495	Depends on dealer
■	Pending	❑	■	■

CONTINUES

FACT FILE



Everex STEP Megacube
Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-992-3839, 510-498-1111.
List price (tested configuration): $12,795.
Memory and processor RAM cache: 16MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 12-ms. 337MB SCSI hard disk, Adaptec controller, 1.2MB floppy disk drive.
Display: Everex adapter with 512K RAM, Everex 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The unique Everex Step Megacube 486/33e EISA system is an appealing computer that begs to be used as a file server. With lots of slots, an ample drive capacity and RAM expansion, and good power and cooling, the Megacube is a rugged, high-powered unit. Apart from minor initial setup hassles, this Novell-certified system performed very well on our tests.

CIRCLE 502 ON READER SERVICE CARD

excellent expansion room, good performance, and design features for system protection that go beyond the norm. Besides that, it sure looks good.

GATEWAY 2000

Gateway 486-33 EISA

BY WENDY DUGAS PÉREZ Gateway 2000's desktop 486-33 EISA is well equipped as a file server: Right from the start, its two duplexed 500MB Maxtor hard disks set it apart from ordinary desktop PCs. Space for only five drives, dictated by the desktop form factor, is one of its few shortcomings, though Gateway expects to remedy this shortcoming when the PC wins FCC approval. In the meantime, while you may not be able to get as much as you would like from this unit, what you do get is worth its price.

At $6,295, our tested configuration consisted of 16MB of RAM, a 128K di-

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—PC Week

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—Computer Shopper

"Outstanding."
—PC Magazine

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ZEOS 486-33 PC MAGAZINE EDITOR'S CHOICE 4-16-91

ZEOS 486-25 PC MAGAZINE EDITOR'S CHOICE 6-25-91

Unleash the power! Unleash your own ZEOS '486 EISA. *PC Magazine* calls it *"outstanding."* If it's your first '486, you will quite likely call it unbelievable. Believe it.

In awarding your new ZEOS '486 the coveted *Editor's Choice Award, PC Magazine* said the ZEOS '486 EISA was "best on our tests." They went on to note the ZEOS '486 is "both surprisingly useable and affordable." But that really shouldn't come as a surprise. After all, this ZEOS '486 powerhouse comes from a family of *Eight* ZEOS Editor's Choice machines. Now let's talk real '486 power:

THE POWER OF EISA

It begins with the EISA bus. *PC Magazine* found that the 32-bit EISA bus when combined with our EISA disk caching controller will provide performance "easily twice as fast (and occasionally ten times as fast) as an AT-bus computer with the same microprocessor and megahertz rating." Now that's *fast!*

But what about compatibility? While the '486 processor offers full software compatibility, the EISA bus will accept your present eight and sixteen bit expansion cards and run them without a hitch. That's the advantage of the EISA bus. Incredible performance with complete compatibility. That's your new ZEOS '486 EISA.

"TWEAKING AND REFINING." A ZEOS HALLMARK.

And, speaking of performance. In their *Editor's Choice* review, *PC Magazine* noted "ZEOS has a reputation for tweaking and refining that shows." That's the ZEOS way. Attention to detail really makes the difference. We're talking about important details, items you may not even notice at first. Like two cooling fans in EVERY ZEOS '486. And cabinets *Loaded* with drive bays. Loaded too with 300 Watts of power and a motherboard that will take up to *32MB right on board.* And more.

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And that's only the start of your ZEOS Customer Satisfaction package. Add to it our 30 Day Absolute Satisfaction Money Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement Policy. You're going to be very satisfied. We don't just say it. *We Guarantee It!*

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CIRCLE 063 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order by company

—Editors' Choice
■—Yes ❑—No

	Insight 486-33 EISA	ME 486-EISA/33	National Micro Systems Flash Server 486-33 EISA	Northgate Elegance 433e	Samsung System Master 486/33TE
List price (*PC Magazine* configuration)	$9,995	$6,999	$5,101	$7,449	$10,194
Hard disk capacity	1.05MB	1.2GB	760MB	676MB	676MB
Distribution channel	Direct	Direct	Direct	Dealers, direct	Dealers
Case style	Tower	Tower	Tower	Tower	Tower
Bus architecture	EISA	EISA	EISA	EISA	EISA
MOTHERBOARD					
Motherboard manufacturer	Intel	Micronics	AIR	Northgate	Samsung
Chip set manufacturer	Intel	Intel	ETEQ	Intel	Intel
System shadowing/Video shadowing	■/■	■/■	■/■	■/■	■/■
BIOS version (or date)	Phoenix 1.10.33.K2	Phoenix 1.00.16	Phoenix 1.01.04	Northgate 6.04q	Phoenix 1.00.05A
Flash memory	❑	❑	❑	❑	❑
Supports 80487/Weitek coprocessor	❑/■	■/■	❑/■	❑/■	■/■
Maximum number of processors supported	1	1	1	1	1
MEMORY AND PROCESSOR RAM CACHE					
Installable RAM	4MB–64MB	4MB–64MB	4MB–64MB	1MB–32MB	1MB–32MB
Cache controller	AT&T	Discrete logic	AIR	Discrete logic	Samsung
Installable RAM cache	128K–512K	64K–256K	256K	128K	128K
Cache architecture and write policy	Look-through, write-back	Direct mapped, write-back	Direct-mapped, write-through	Write back	Direct-mapped, write-back
DISK DRIVES					
Front-accessible drive bays	Four 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Six 5.25-inch, no 3.5-inch	Eight 5.25-inch, no 3.5-inch	Three 5.25-inch, one 3.5-inch
Internal drive bays	4	2	6	None	4
Minimal floppy disk drive configuration	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB or 1.44MB	1.2MB, 1.44MB
Hard disk options	100MB–6.5GB	40MB–1.2GB	80MB–1GB	100MB–1.2GB	676MB
Disk controller location	Card	Card	Card	Card	Card
Drive array available	❑	❑	❑	■	❑
Tape backup available	Wang (included)	Colorado Memory Systems ($1,000)	Colorado Memory Systems ($700)	Mountain ($3,429)	None
EXPANSION BUS					
8-bit slots	None	None	None	None	None
16-bit slots	None	None	None	None	None
32-bit EISA/MCA slots	8 (3 open)	8 (5 open)	8 (5 open)	8 (6 open)	8 (5 open)
32-bit proprietary slots	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	1, 2, 1	None	1, 2, 0	1, 1, 1	None
VIDEO					
Tested display mode	VGA	VGA	Monochrome	MDA	Super VGA
Display circuitry location	Card	Card	Card	Card	Card
Video chip set manufacturer	Tseng	Tseng	Winbond	MG	Intel
POWER SUPPLY					
Power supply (watts)	350	375	300	450	270
Number of device connectors	6	10	8	5	7
SOFTWARE					
DOS	5.0	5.0	5.0	5.0	5.0
NetWare, Version 3.11	Not available	$4,500	$4,995	$2,349 (20-user)	Not available
Other operating systems supported	OS/2, Unix	OS/2, Unix, Xenix	OS/2, Unix, Xenix	OS/2, Unix	*NetWare*, OS/2, Unix, Xenix
MISCELLANEOUS					
Warranty	1 year	2 years	15 months parts, 2 years labor	1 year	1 year
First year on-site service charge	N/A	$50	$100	Included	$155
Novell certification	❑	■	❑	■	❑

N/A—Not applicable: The product does not have this feature
AIR—Advanced Integration Research, ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc
C&T—Chips and Technologies Inc., ETEQ—ETEQ Microsystems Inc

SST 486-33ME	Swan 486/33E	Systems Integration Associates SIA 486/33E	Tangent Model 433e	Tri-Star Flash Cache 486E	Wang EC 480/33C	Zeos 486-33E
$8,775	$7,674	$16,745	$7,838	$6,995	$17,955	$9,740
2.4MB	800MB	3.06GB	678MB	1.52GB	632MB	660MB
Direct	Direct	Dealers	Direct	Direct	Dealers, direct	Direct
Tower	Tower	Tower	Tower	Tower	Desktop	Tower
EISA	EISA	EISA	EISA	EISA	EISA	EISA
Micronics	Anigma	Mylex	Mylex	Free	Intel	Mylex
Intel	Intel	Intel	Intel	Intel	Intel	Intel
■/■	■/■	■/■	■/■	■/■	■/■	■/■
Phoenix 1.00.16	Award 4.26	MAE 6.04	Mylex 6.04	Award	Phoenix 1.10.30R2	Mylex 6.04
❑	■	❑	❑	❑	❑	❑
■/■	❑/■	■/■	■/■	■/■	■/■	■/■
1	1	1	1	1	1	1
1MB–64MB	1MB–64MB	1MB–32MB	1MB–32MB	1MB–64MB	2MB–64MB	1MB–32MB
Discrete logic	Anigma	Proprietary	Discrete logic	Discete logic	Intel	Discrete logic
64K–256K	128K–256K	128K	128K	64K–256K	128K	128K
Direct-mapped, write-back	Direct-mapped, write-back	Direct-mapped, write-back	Direct-mapped, write-back	Two-way set-associative, write-through	Direct-mapped, write-through	Direct-mapped, write-back
Four 5.25-inch, one 3.5-inch	Five 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Five 5.25-inch, no 3.5-inch	Five 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch
2	2	7	4	2	2	4
1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB
52MB–1.2GB	120MB–1.6GB	150MB–1.4GB	50MB–2.4GB	330MB–1.2GB	40MB–1.2GB	42MB–1.1GB
Card	Card	Card	Card	Card	Card	Card
❑	❑	■	■	❑	❑	❑
Colorado Memory Systems ($1,175)	Colorado Memory Systems ($799)	SIA ($3.876)	Sankyo ($1,145)	Colorado Memory Systems ($1,195)	Archive ($1,995)	Wangtek ($995)
None	None	None	None	None	None	None
None	None	None	None	2 (1 open)	None	None
8 (5 open)	8 (5 open)	8 (4 open)	8 (6 open)	6 (4 open)	8 (6 open)	8 (4 open)
None	None	None	None	None	None	None
None	None	None	None	None	2, 2, 1	None
VGA	Monochrome	Super VGA	Monochrome	Super VGA	Super VGA	VGA
Card	Card	Card	Card	Card	Card	Card
Tseng	Sierra	Tseng	Winbond	Tseng	C&T	Tseng
275	320	450	300	250	300	450
5	5	8	6	6	5	4
5.0	5.0	5.0	5.0	5.0	5.0	5.0
$5,000	Not available	Not available	$2,387	Not available	$6,995	Not available
OS/2, Unix, Xenix	OS/2, Unix	OS/2, Unix	OS/2, Unix, Xenix	OS/2, Unix	OS/2, Unix, *VINES*	OS/2, Unix, Xenix
1 year	1 year	1 year	1 year	2 years	1 year	1 year
Included	Included	Depends on dealer	Included	Included	$504	$49
❑	Pending	■	❑	■	■	❑

ENDS

BENCHMARK TESTS

Of the 22 EISA and MCA 486/33-based file servers in this review, 19 performed almost identically. The Tri-Star, IBM, and Compaq systems fell markedly below average in evaluation-station throughput.

WHAT THE NUMBERS MEAN

EVALUATION-STATION THROUGHPUT

On our fully loaded network, on which 31 client PCs performed the Hard Disk Access Load portion of PC Magazine Labs' LAN benchmark tests, the tested servers allowed an average throughput of 0.52 megabits per second (as measured by a thirty-second client PC—the evaluation station). This is less than half the average throughput speed of 1.16 Mbps, which was measured under a no-load condition.

Only the Tri-Star Flash Cache 486E, IBM PS/2 Model 95 XP 486, and Compaq Systempro/LT 486/33-510 fell markedly below those averages. As for the throughput leaders, the remaining 19 machines performed so similarly that it is impossible to declare a leader.

We noted a throughput decrease of approximately 20 percent when we increased each tested server's network load from 0 to 8, 8 to 16, and 16 to 24 client stations. Throughput dropped only 10 percent, however, when we connected the last 7 client PCs to the network.

This pattern repeated itself for all the tested servers except the only MCA (Micro Channel architecture) system in this review, IBM's PS/2 Model 95. When we connected the client PCs to the Model 95, the initial evaluation-station throughput (1.09 Mbps under no load) decreased by about 25 percent each time we increased the workstation load. When the load increased from 24 to 31 client PCs, the evaluation-station throughput decreased 15 percent to 0.37 Mbps. IBM attributed this performance shortfall to Madge Networks' MCA Ringnode Token-Ring network interface card (NIC), which IBM says does not maximize the benefits of MCA.

Compaq's Systempro/LT and Tri-Star's Flash Cache also produced noticeably below-average results. The Systempro/LT, which used a conventional ISA interface and a Conner CP3501 IDE hard disk despite the system's EISA architecture, produced a throughput of 0.98 Mbps under no load and fell to 0.46 Mbps under a full load, compared with respective averages of 1.16 Mbps and 0.52 Mbps for the test group. The Flash Cache, which has proprietary, discrete processor support and cache logic, was the poorest performer of the 21 EISA systems. This server used 18-millisecond Maxtor XT7660E hard disks and yielded an evaluation-station throughput of 0.81 Mbps under

HARD DISK ACCESS LOAD

EVALUATION-STATION THROUGHPUT (megabits per second)

	Workstations				
	No load	8	16	24	31
Dell PowerLine 433DE	1.20	0.96	0.77	0.60	0.54
Northgate Elegance 433e	1.19	0.98	0.77	0.60	0.54
Blackship 486/33 EISA	1.20	0.98	0.76	0.60	0.54
Everex STEP Megacube	1.20	1.00	0.76	0.60	0.54
Insight 486-33 EISA	1.20	0.99	0.76	0.60	0.54
Samsung System Master 486/33TE	1.19	0.98	0.76	0.60	0.54
SIA 486/33E	1.20	0.98	0.76	0.60	0.54
Swan 486/33E	1.20	0.99	0.76	0.60	0.54
Tangent Model 433e	1.20	0.98	0.76	0.60	0.54
Wang EC 480/33C	1.20	0.98	0.76	0.60	0.54
Zeos 486-33E	1.19	0.95	0.76	0.60	0.54
ME 486-EISA/33	1.19	0.98	0.75	0.60	0.54
Gateway 486-33 EISA	1.19	0.96	0.76	0.59	0.54
Hertz 486/33EI	1.19	0.98	0.76	0.59	0.54
Amkly 486/33E	1.20	0.97	0.75	0.59	0.54
NMS Flash Server 486-33 EISA	1.19	0.98	0.75	0.59	0.53
SST 486-33ME	1.17	0.95	0.71	0.57	0.52
CompuAdd 433E	1.20	0.94	0.72	0.56	0.50
ALR PowerPro VM 486/33	1.16	0.97	0.67	0.53	0.47
Compaq Systempro/LT 486/33E-510	0.98	0.75	0.61	0.51	0.46
Tri-Star Flash Cache 486E	0.81	0.67	0.58	0.54	0.45
IBM PS/2 Model 95 XP 486	1.09	0.80	0.59	0.44	0.37

SERVER UTILIZATION (percent)

	No load
Compaq Systempro/LT 486/33E-510	16.83
Samsung System Master 486/33TE	14.25
Dell PowerLine 433DE	11.00
SST 486-33ME	10.50
IBM PS/2 Model 95 XP 486	9.50
Amkly 486/33E	7.83
Tri-Star Flash Cache 486E	7.58
Hertz 486/33EI	7.25
NMS Flash Server 486-33 EISA	6.92
Zeos 486-33E	6.92
ALR PowerPro VM 486/33	6.50
ME 486-EISA/33	6.33
Gateway 486-33 EISA	5.83
Swan 486/33E	5.83
Northgate Elegance 433e	5.83
CompuAdd 433E	5.75
SIA 486/33E	5.58
Insight 486-33 EISA	5.50
Everex STEP Megacube	5.42
Blackship 486/33 EISA	5.33
Tangent Model 433e	5.33
Wang EC 480/33C	5.00

Higher scores represent better performance.

no load. Throughput fell to 0.45 Mbps under a full load.

SERVER UTILIZATION

How hard did our 22 tested servers work to achieve these throughput results? Server utilization measurements provided by the *NetWare* monitor showed the percentage of the server's CPU resources consumed at any time during the tests. As expected, the average usage was light—7.5 percent—when the Hard Disk Access Load benchmark test was run under a load other than the one evaluation station. Average utilization jumped to 45 percent under an 8-station load and leveled off at about 60 percent under 16-, 24-, and 31-station loads. The least-worked system in the group was the Dell PowerLine 433DE; it handled the loads of 16, 24, and 32 stations (including the evaluation station) using slightly more than 50 percent of its CPU's processing capacity. A dozen other systems, including Gateway, Zeos, SIA, Tangent, and Insight had better-than-average utilization scores.

The hardest-working server in the group was the SST 486-33ME, which used more of its processing power than others to return its average throughput performance. This system's proprietary discrete-logic support circuits and cache controller may account for its performance. The Systempro/LT, which used an ISA IDE hard disk, and the NMS Flash Server 486-33 EISA required about 70 percent of their resources while supporting the fully loaded network during PC Labs' Hard Disk Access Load test. Under a no-load condition, both the SST 486-33ME and Systempro/LT were above-average performers, while the Flash Server, at 7 percent, was average.

Workstations			
8	16	24	31
52.58	70.33	71.08	72.83
42.83	59.50	60.25	58.75
38.75	51.33	52.67	52.25
60.42	80.58	83.75	83.50
50.08	66.33	67.92	66.17
47.42	63.17	64.42	63.17
45.00	57.50	58.42	57.67
44.75	61.08	62.50	61.08
50.83	68.00	70.00	70.00
42.67	55.08	54.92	54.42
44.17	61.00	62.83	65.00
45.83	63.00	60.92	63.58
42.33	56.83	58.58	54.42
42.17	55.75	58.00	56.17
42.08	55.75	57.75	56.67
43.25	56.58	57.75	56.92
40.08	53.25	54.92	54.42
39.33	52.92	54.08	52.83
42.67	57.75	59.17	57.42
41.42	55.50	57.17	55.83
37.67	52.83	55.58	54.83
41.67	55.58	55.00	57.00

HOW WE TESTED

To evaluate the performance of the 22 EISA and MCA 486/33 PCs in this review, we configured each system as a network server, attached it to a network of 32 client PCs, and ran PC Magazine Labs' LAN benchmark tests under Novell's *NetWare*, Version 3.11. This suite of benchmark tests has three exercises: a Hard Disk Access Load test, a Directory Access Load test, and a Network Speed Load test. During each exercise, we measure the throughput of a single client PC (known as the evaluation station), the total work done by other client PCs on the network, and the amount of work the server's CPU does while it serves the clients.

Our 32-node network consisted of four 4-Mbps Token-Ring cards. Each ring serviced eight client PCs. We installed four Ringnode bus-mastering NICs, supplied by Madge Networks, in each server.

CLIENT PCs

The first two Token-Ring NICs in each server were attached to a mix of 16 20-MHz 486SX-based PCs and 40-MHz 386-based PCs. We attached eight 16-MHz 386SX-based Compaq Deskpro 386Ns to the third NIC and eight more 486SX/20s to the fourth.

The first station on the second ring was arbitrarily chosen as the evaluation station, and it conducted sequential and random read-write operations on a 5MB file using 512-byte, 4K, and 16K records. First the evaluation station ran the cycle under a no-load condition (no client PCs performed any operations). Then the station performed the same operation while 8, 16, 24, and 31 client PCs, equally distributed among the four rings on the LAN, executed PC Labs' Hard Disk Access Load, Directory Access Load, and Network Speed Load tests.

During each test cycle, we measured the **Evaluation-Station Throughput** figures for each combination of sequential and random read-write operations and three record sizes. We averaged the results to compute the throughput, measured in megabits per second, for each load condition (no load or 8, 16, 24, or 31 client PCs).

During each cycle, we also recorded the **Server Utilization** as reported by the *NetWare* monitor. That score, a percentage of the server CPU's maximum processing ability, indicates how hard that CPU is working for each test and with each load condition.

In addition, we measured the number of operations that each workstation completes during the test cycle. This leads to an average work estimate for each Token-Ring, expressed in operations per second for each cycle (Hard Disk Access Load, Directory Access Load, and Network Speed Load) and load/condition combination.

THE BACKGROUND TESTS

Though we ran the PC Labs' full LAN benchmark test suite, we are reporting only the throughput and utilization scores measured under no-load conditions and while client PCs ran the Hard Disk Access Load test. In this phase, we found the most significant differences among the tested systems.

During the **Hard Disk Access Load** test, each client PC reads random 1K segments from a 10K file while the evaluation station performs its 5MB file operations.

The **Directory Access Load** test makes the server search repeatedly for a nonexistent file. Since the server's file-allocation table is typically cached, this request from all of the client PCs causes a fast read to the cache and places a heavy load on the server CPU. The task is similar to those handled by network monitoring programs or communications programs.

The **Network Speed Load** test requires each PC to perform 1-byte reads from and writes to the server. Because the same byte is being accessed, it resides in *NetWare*'s disk cache and requires no hard disk access; it gives an indication of both the network speed and the server capacity.

FACT FILE

Gateway 486-33 EISA
Gateway 2000, 610 Gateway Dr., N. Sioux City, SD 57049; 800-523-2000, 605-232-2000.
List price (tested configuration): $6,295.
Memory and processor RAM cache: 16MB 70-ns. SIMMs, 128K cache.
Disk drives and controller: Two Maxtor 12.5-ms. 500MB SCSI hard disks, Adaptec controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Gateway 2000 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The Gateway 486-33 EISA is a good performer with quality components, and only its small size detracts from its use as a server. This system is still worth considering because of its fine documentation and the company's attention to value.

CIRCLE 503 ON READER SERVICE CARD

rect-mapped cache, two duplexed 500MB Maxtor SCSI hard disks with 32-bit Adaptec EISA controllers, and two floppy disk drives. The video display subsystem consisted of a Diamond SpeedSTAR VGA video adapter, which had a Tseng chip set and 1MB of video RAM, paired with Gateway's 14-inch noninterlaced Crystal Scan monitor. Though the hard disk controllers had no cache, the Gateway's performance was well within range. Its CPU utilization score on the Hard Disk Access Load test was better than average.

The Gateway came with an Anigma motherboard, an Intel chip set, and an Award BIOS. RAM starts at the system-standard 8MB and ranges to a system total of 64MB on the motherboard, using 70-nanosecond SIMMs. Our test unit had eight 32-bit EISA slots, with four of them open—just enough space for the four NICs we installed. The other slots were filled by the two Adaptec hard disk controllers, the video board, and a serial/parallel/game I/O board. The motherboard also harbors an additional serial port.

Gateway is awaiting FCC approval for a tower case with six bays. Of the five drive bays in the tested model, three are accessible from the front. The two duplexed 500MB Maxtor hard disks occupy the internal drive bays, so you can reserve the accessible drives for removable media, such as a 120MB internal tape backup unit ($295). Other hard disk options range from 40MB to 1.2GB.

The drawback with the current model, however, is that the power supply is a comparatively light 200 watts and will require Y splitters if you connect more than four drives.

Although Gateway 2000 markets this system as a server, it does not sell network adapters or operating systems, or offer networking support. What Gateway does offer instead is a standard one-year parts-and-labor warranty that includes on-site service by TRW free for the first year. A toll-free number connects you to technical support weekdays from 6:00 A.M. to 12:00 midnight C.S.T. and Saturday from 9:00 to 2:00. There is no charge for the service. However, Gateway's manual is so good that you might not have to use the company's technical support. But if experience has convinced you that anyone who has a network has networking problems, you would be wise to check what kind of network support is available as a safety net.

HERTZ COMPUTER CORP.

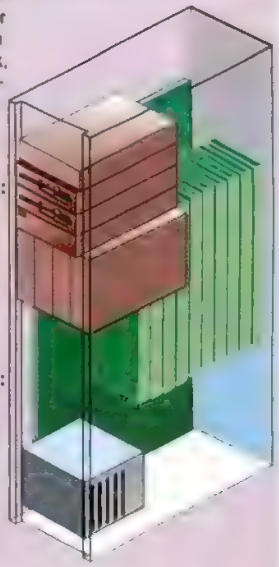
Hertz 486/33Ei

BY PATRICK HONAN Hertz Computer Corp. sent PC Magazine Labs one of the most robust systems in this review, yet the price of the Intel-made Hertz 486/33Ei makes it a fine contender for your dollars.

For $14,885, you will get more storage and memory than you can use: 64MB of RAM, a 128K RAM cache, a 2GB SCSI hard disk and EISA SCSI controller packed with 4MB of cached RAM, and two floppy disk drives. The configuration also includes a Diamond SpeedSTAR Super VGA board, a Tatung 1498X Super VGA monitor, Microsoft Windows 3.0, and DOS 5.0. Hertz even installs and configures *NetWare*, Version 3.11, or Unix free of charge. Of course, you still have to buy the software.

The Hertz has a Phoenix 486 EISA ROM BIOS and an Intel chip set. Its Intel motherboard carries 64MB of RAM in

FACT FILE
EDITORS' CHOICE



Hertz 486/33Ei
Hertz Computer Corp., 325 Fifth Ave., New York, NY 10016; 800-232-8737, 212-684-4141.
List price (tested configuration): $14,885.
Memory and processor RAM cache: 64MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Micropolis 14-ms. 2GB SCSI hard disk, DPT controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Tatung 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: Built like a tank and configured to the max, the Intel-manufactured Hertz 486/33Ei is a serious contender for your server dollars. The company filled this PC with 2GB of storage and 64MB of RAM, two internal cooling fans, and a 396-watt power supply—enough for the busiest network.

CIRCLE 504 ON READER SERVICE CARD

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Keyboard:	84-key Keyboard
Mouse:	Logitech TrackMan Portable
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Storage:	52MB IDE Hard Disk Drive
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Display:	14" Multi-sync VGA Color Monitor
Keyboard:	101-key Keyboard
Mouse:	Three-button Mouse
Operating Systems:	MS-DOS 5.0 and MS-Windows 3.0

Special Package Price **$1,999**

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The **DEC**pc 433 Workstation

Includes:

Microprocessor:	Intel i486 running at 33MHz
Memory:	8MB, 70ns Memory Kit
Storage:	40MB IDE Hard Disk Drive 3.5" 1.44MB Floppy
Resolution Mode:	1280 X 1024 TIGA Adapter
Display:	20" Color Monitor
Keyboard:	101-key Keyboard
Mouse:	Three-button Mouse
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DECpc 320P Notebook Personal Computer. Features and Specifications.

Processor:	i386sx
Clock:	20MHz
Memory:	2MB (Exp 8MB)
Expansion Slots:	1 proprietary data modem (or FAX modem)
Storage:	40MB or 80MB IDE Hard Drive 3.5" 1.44MB Floppy Drive
Display:	VGA LCD Triple Super Twist Backlit
Power:	Removable/Rechargeable NiCad Battery Pack AC Adapter 104-264V
Battery Life:	3+ Hours
Input Devices:	84-key Keyboard w/numeric Keypad built in Logitech Trackman Portable Optional External full size 101-key Keyboard
Ports:	Serial/Parallel, Keyboard, VGA
Operating System Supported:	MS-DOS 5.0
GUI:	Windows 3.0
Resolution Mode:	640 x 480
Modem:	2400 baud or 9600 baud data/FAX Modem
Dimensions:	12.2"L x 10"W x 1.7"H
Weight:	6.4 lbs.
Networks:	PATHWORKS™ Novell NetWare™ Banyan Vines®
Environmental:	Operating Temp. 40°F-100°F

*Not applicable to all applications.

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DECpc 420sx. Information and Specifications

DECpc 420sx: Recommended Start-Up Configuration (Details below.)

DECpc 420sx. Advanced technology, design and features facilitate fast, efficient performance – and help you maximize software applications.

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Housed in a space-saving low-profile system box, the 420sx features Intel's high performance 486sx 20MHz processor, support for up to 32MB directly addressable memory, VLSI® Technology's state-of-the-art "TOPCAT®" chipset – which offers the latest in high integration and flexible configuration features – and cutting edge non-interlaced video technology for 1024 X 768, 256 color graphics.

Other *standard* features include an 8KB integrated cache for further performance enhancements, 512KB VRAM (optional 1MB-VRAM), IDE interface, MS-DOS 5.0, Windows 3.0, 3 PC/AT® expansion slots and a 3-button mouse.

Importantly, all 420sx components – including the CPU and memory – are installed on the main logic board (MLB), which enhances system performance *without* increasing system cost. The 420sx is suitable for use both as a standalone *and* a network client, and is both PATHWORKS and Novell NetWare Certified.

DECpc 420sx. System Configurations

(DECpc 420sx with 8KB Cache, 512KB VRAM, SVGA Adapter, 3.5" Floppy, IDE Controller, DOS 5.0, Windows 3.0, Mouse, Keyboard)*

	VGA Monochrome		VGA Multi-sync Color		16" VGA Color*	
	4MB	8MB	4MB	8MB	4MB	8MB
52MB	$2,299 (DJ-PC445-01)	$2,649 (DJ-PC445-02)	$2,599 (DJ-PC445-03)	$2,949 (DJ-PC445-04)	$3,149 (DJ-PC445-05)	$3,499 (DJ-PC445-06)
105MB	$2,499 (DJ-PC445-07)	$2,849 (DJ-PC445-08)	$2,799 (DJ-PC445-09)	$3,149 (DJ-PC445-10)	$3,349 (DJ-PC445-11)	$3,699 (DJ-PC445-12)

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DECpc 420sx. Recommended Start-Up Configuration

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- VGA Multi-sync Color Monitor

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DECpc 420sx

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OPTION/ACCESSORY	ORDER No.	PRICE
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DECpc 420sx, 1.44MB 3.5" Floppy, 4MB memory, SVGA+, IDE Controller, Mouse, Keyboard Ports, Serial/Parallel Ports	FR-PC445-AA	$1,450
OPERATING SYSTEM		
MS-DOS 5.0 and Windows 3.0	QB-MESAA-TA	$160
MS-DOS V3.3 and QEMM 5.1	FR-PC4XQ-AA	$85
MS-DOS V4.0 and QEMM 5.1	FR-PC4XQ-BA	$100
OS/2 V1.21 with Presentation Manager™	FR-PC4XQ-CA	$250
MEMORY		
512KB SIMM (Two 256KB 80ns)	FR-PC4XM-CA	$60
2MB SIMM (Two 1MB 80ns)	FR-PC4XM-CB	$175
8MB SIMM (Two 4MB 70ns)	FR-PCXAM-DC	$650
STORAGE DEVICES		
3.5" 1.44MB Floppy Disk	FR-PC4XR-FA	$100
5.25" 1.2MB Floppy Disk	FR-PC4XR-EA	$100
5.25" 360KB Floppy Disk	FR-PC4XR-GA	$100
3.5" 52MB IDE Hard Disk Drive	FR-PC4XR-BD	$400
3.5" 105MB IDE Hard Disk Drive	FR-PC4XR-EB	$600
3.5" 120MB IDE Hard Disk Drive	FR-PC4XR-DB	$650
3.5" 209MB SCSI Hard Disk Drive	FR-PCXAR-AA	$900
3.5" 426MB SCSI Hard Disk Drive	FR-PCXAR-AB	$1,500
5.25" 60MB Tape Drive (DOS Only)	FR-PC4XT-CA	$265
SCSI ADAPTER (IF A SCSI DRIVE IS SELECTED)		
SCSI Adapter Board with External Connector	FR-PC4XR-CC	$250
COMMUNICATIONS OPTIONS		
Additional Parallel/Serial Port Adapter	FR-PC4XD-AA	$60
Dual Serial Port Adapter	FR-PC4XD-AB	$90
Internal 2400 BPS Modem	FR-PC4XD-CA	$100
VIDEO MONITORS		
14" Monochrome Monitor	FR-PC4XV-A2	$200
14" VGA Color Monitor	FR-PCXCV-B2	$400
14" Multi-sync Color Monitor	FR-PC4XV-B2	$500
16" Color Monitor 72Hz	FR-VRC16-CA	$1,000
VIDEO ADAPTER MEMORY UPGRADE		
512KB Video RAM Upgrade Kit (1024 x 768)	FR-PCXAM-AA	$60
KEYBOARDS		
101-key Industry Standard	FR-PCXAL-AA	$75
Digital Gold-Key Style	FR-LK250-PA	$100
ACCESSORIES		
3-Button Mouse	FR-PCXAS-AA	$35
REFERENCE		
Technical Reference Guide for 420sx	FR-PC44Y-EE	$70
Multi Language Users Guide for 420sx	FR-PC44Y-CF	$20

Processor:	i486sx
Clock:	20 MHz
Memory:	4MB expandable to 32MB (8KB integrated cache)
Bus Type:	AT
Expansion Slots:	3 PC/AT
Storage Bays:	2 available Front Bays (3.5", 5.2")
Storage (Disk):	3.5" 1.44MB Floppy Drive, 52MB, 105MB, 120MB IDE 3.5" 209MB, 426MB SCSI 3.5" (Tape) 60MB Floppy (DOS Only)
Display VGA Monitor:	VGA Color VGA Multi-sync Color (1024 x 768) 16" color (1024 x 768)
Power:	100 Watts
Mouse:	3-Button Logitech
Operating Systems Supported:	MS-DOS 5.0 OS/2 1.21
GUI:	Windows 3.0 Presentation Manager (All Future Releases)
Resolution Mode:	1024 x 768
Network:	PATHWORKS Certified Novell NetWare Certified
Dimensions:	4.25"H x 15"W x 15.5"D
Environmental Operating:	120V, FCC Class B, Temp. 50°F to 95°F

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- ☐ DECpc i486 and i486sx based systems
- ☐ The DECpc 320P Notebook
- ☐ The Catalog

Customization Worksheet

Your base system is a: ☐ 286 ☐ 386 ☐ 486 ☐ Other

How many applications will your PC(s) run in a typical workday? _____

What best describes the type of work the system will be used for? (Check all that apply)

- ☐ Word Processing
- ☐ Order-entry
- ☐ Database (filing records)
- ☐ Financial Calculations
- ☐ Retail Store Management
- ☐ Desktop Publishing
- ☐ Education
- ☐ Design (CAD/CAM)
- ☐ Engineering
- ☐ Industrial Process Control
- ☐ Scientific Research
- ☐ Software Development
- ☐ E-Mail
- ☐ Other industry-specific applications (please specify)

How many people work in your group, department or small business?
☐ Less than 10 ☐ 10-20 ☐ 20-35 ☐ More

Is your operating system:
☐ DOS ☐ DOS with Windows ☐ OS/2 ☐ MAC ☐ UNIX™ ☐ Other

Which of the following graphics-oriented applications best describes your needs? (Check all that apply)

- ☐ Desktop Publishing
- ☐ CAD/CAM
- ☐ Realtime Modeling
- ☐ Animation
- ☐ Image Processing
- ☐ AutoCad
- ☐ Business Graphics

LAN Communication

How many PCs do you have installed? _____ From how many manufacturers? _____

What kinds of connections does your PC(s) require? (Check all that apply)

- ☐ Links with other PCs in the immediate surroundings
- ☐ Connection to the local area network (LAN) throughout a building
- ☐ A line to a host system in a remote location

What kind of media (cable) is used in your LANs today? _____

What is the networking software now being used in your company? _____

What kind of host system will your PC communicate with?
☐ DEC ☐ IBM ☐ Other _____

What Kind of Service Do You Really Need?

☐ On-site Hardware Support ☐ Software Support ☐ Telephone Support
☐ Training ☐ FAX Hotline

How many of your users take portables on the road? _____

Do you currently have a service contract(s) for your PCs? ☐ How many? _____

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total, in 80-nanosecond interleaved-page SIMMs. The 128K RAM cache is the only size available.

Since the Hertz's case measures 24.5 by 7 by 25 inches and weighs 80 pounds with no drives installed, you will want to think first and move later. A handle at the front bottom of the case makes the PC easier for you to grab; a similar case accepts casters and is worth the $49 that Hertz charges.

At least the company makes good use of the Hertz's enormous case. Inside are eight standard-height 5.25-inch drive bays, four of which are accessible from the front. There is no need to deal with Y splitters, even for a fully loaded machine, because the power supply has eight connectors. Two of the ten EISA slots hold the Super VGA board and the hard disk controller, leaving four open even after we installed four NICs. Since the system's five ports (two parallel, two serial, and one mouse) are integrated on the Intel motherboard, no additional I/O boards are necessary.

The 396-watt power supply handles even a fully loaded system quite well, and two internal fans prevent overheating. Internal components are spaced well apart, making it easy to reach a SIMM chip or install a drive.

The Micropolis 2GB SCSI hard disk and the EISA SCSI controller from Distributed Processing Technology should provide enough storage and speed for just about any network installation. You can configure the DPT controller with a RAM cache ranging from 512K to 16MB. On the Hard Disk Access Load test, the Hertz unit performed as well as most of the tested systems.

The Hertz is Novell and Banyan certified. The company also offers a unique program where it will provide technical training for the PC at Hertz's New York office. The cost? None, since Hertz believes this training is an investment that will mean fewer calls to technical support once the machine is installed at a customer's site.

Hertz backs the Hertz 486/33Ei with one-year parts-and-labor coverage. On-site service is available from Intel Service Group as a $495 option during the first year of ownership. Toll-free technical support lines are open on weekdays from 9:00 to 5:00 E.S.T.

The Hertz 486/33Ei has excellent expansion capabilities, but it is much more than just a big box. With features such as easy access to components, a large power supply, and two cooling fans, this server is a solid value, especially if you have a large network.

IBM CORP.

IBM PS/2 Model 95 XP 486

BY WENDY DUGAS PÉREZ IBM is finding it tough going these days, what with so many other vendors turning out quality systems at a fraction of IBM's prices. One example is the IBM server reviewed here, which is priced at $26,405. While there are many good reasons to buy from IBM, there is one significant drawback: If you do buy an IBM server, you really must buy everything else from IBM—especially, in this case, its NICs.

The price for the system we tested included 16MB of RAM, 256K of two-way set-associative external RAM cache, a 400MB SCSI hard disk paired with a controller that had 512K of RAM cache, three additional 400MB 11.5-millisecond SCSI hard disks (bringing the total to about 1.6GB of hard disk storage), a 1.2MB and a 1.44MB floppy disk drive, a 14-inch IBM 8515 color monitor, and an XGA video adapter with 256K of RAM. Even a base-priced system, with 8MB of RAM, 400MB of storage, and XGA video with IBM's 8515 monitor, sells for more than $15,000.

When we compared this MCA-based Model 95 (equipped with a Madge Networks Ringnode MCA network adapter) with the EISA systems in this review, it showed markedly poorer performance than the EISA units. One reason could be that the Madge MCA card had a 16-bit data path, while the EISA cards had a 32-bit path. (For more information, see the sidebar "Problem Report: Four Dropouts, One Underachiever.") The server-utilization numbers for the Model 95 were low, however, indicating favorably that the system had not reached its maximum capabilities.

IBM faults the Madge MCA network adapters, which we used to maintain consistency with testing in previous re-

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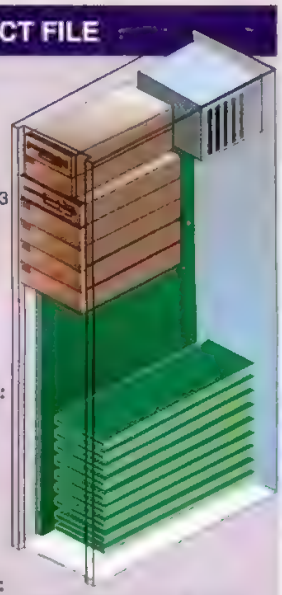

IBM PS/2 Model 95 XP 486
IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; 800-426-9292, 914-642-5368.
List price (tested configuration): $25,455.
Memory and processor RAM cache: 16MB 70-ns. SIMMs. 256K cache.
Disk drives and controller: Four IBM 11-ms. 400MB SCSI hard disks, two IBM controllers with 512K cache. 1.2MB and 1.44MB floppy disk drives.
Display: IBM XGA adapter with 256K RAM, IBM 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The robustly configured IBM PS/2 Model 95 XP 486 came with 1.6GB of storage and 16MB of RAM, but it has the highest price in this group. Performance of this sole Micro Channel architecture system was poorer than that of the EISA machines in this roundup, but IBM attributes the difference in throughput to the use of a 16-bit Madge Networks card and recommends its own adapter instead. Madge's EISA cards have a 32-bit data path.

CIRCLE 505 ON READER SERVICE CARD

DTK 486 drives high-performance software in PC Week Labs test.

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CIRCLE 102 ON READER SERVICE CARD

views, to account for the Model 95's poor performance. The company claims that because the Madge adapter has a cycle that runs at about one-quarter the speed of the Micro Channel architecture's default cycle time, it imposes a handicap on the Model 95 by not fully using the Micro Channel bandwidth.

IBM says that although the Micro Channel architecture is robust enough to support slow asynchronous devices, the Madge card's slow cycle time, coupled with its 16-bit transfer rate, misuses the flexibility and compromises performance. The company further states that adding four adapters, as we did for our test-bed, will not improve server throughput. IBM recommends using the IBM 16/4 network adapters, which it claims would improve throughput times. These are available for $1,030 each.

IBM components include the motherboard, chip set, and video chip set; both video and system shadowing is possible. RAM consists of 70-nanosecond SIMMs up to a system total of 64MB. Putting the processor on a card in a proprietary expansion slot lets you upgrade the system speed to 50 MHz.

The Model 95 we tested had five front-accessible 5.25-inch drive bays and two internal ones. While the 329-watt power supply had only three device connectors, you can connect them with Y splitters to support six drives. Hard disk options range from 80MB to 400MB.

The Model 95 had eight 32-bit MCA slots, with one left free on our test system after we had installed the four NICs. The other three slots were filled by the video card and the two hard disk controllers.

IBM offers a limited one-year warranty through dealers, although service policies may vary. Until IBM's prices are competitive for the components installed, the IBM PS/2 Model 95 XP 486 is not worth the extra money.

INSIGHT COMPUTERS

Insight 486-33 EISA

BY KELLYN BETTS Insight Computers is one of the newer mail-order companies to build a reputation based on combining rather than designing. The value of cramming quality components into the case is clear when you're building regular PCs, but using this method when trying to build a server shows some weaknesses.

There are some advantages to this approach: For a surprisingly low price of $9,995, Insight managed to pull together a very powerful system for us. The huge tower case the company sent us included 16MB of RAM with a 128K cache, a 15-millisecond 1.05GB hard disk with a Seagate SCSI controller and 4MB of cache, two floppy disk drives, an Orchid Fahrenheit 1280 video board, a 1.3GB Wang DAT tape backup unit, and a Chinon CD ROM drive. That powerful lineup should make an excellent value.

The Insight 486-33 EISA also performed adequately on PC Magazine Labs' LAN benchmark tests. It took us a while to get it to the point where we could actually test it, however. The main problem was that Insight did not send us a configuration we could use. It didn't leave enough empty slots to install the four Token-Ring network cards our tests required. Although the hard disks, CD ROM drives, and tape drives could have been attached to the same SCSI controller, Insight sent us separate controllers for each in addition to separate video and I/O cards. In order to install our four NICs, we had to pull the CD-ROM and the tape drive controllers.

An Insight spokesperson explained that this problem could have been solved by using a SCSI card that came with the proper device drivers, which the company does offer. The Insight 486-33 EISA we looked at was almost fully loaded, however. You probably would not want to install any more cards in it.

The company's rationale for combining this particular group of components is that a 1GB hard disk should be more than sufficient for most server needs. Tape backups are essential for data integrity, and CD ROM drives represent the future for many applications. The Mylex SCSI EISA caching controller is one of the most expandable and compatible units available at this time. With its eight drive bays, the system we reviewed also had room for three additional half-height mass-storage devices. And Insight offers a broad selection of drives to fit in that empty space—units up to 6.5GB in size.

Insight offers a one-year parts-and-labor warranty and an 800 technical support line, though there is no on-site ser-

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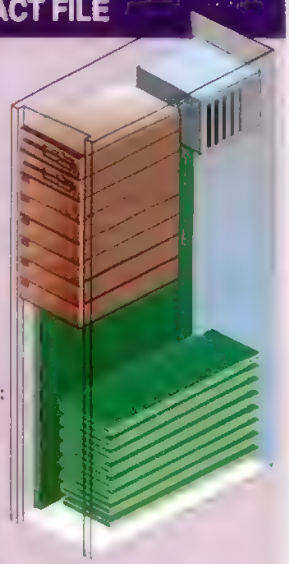
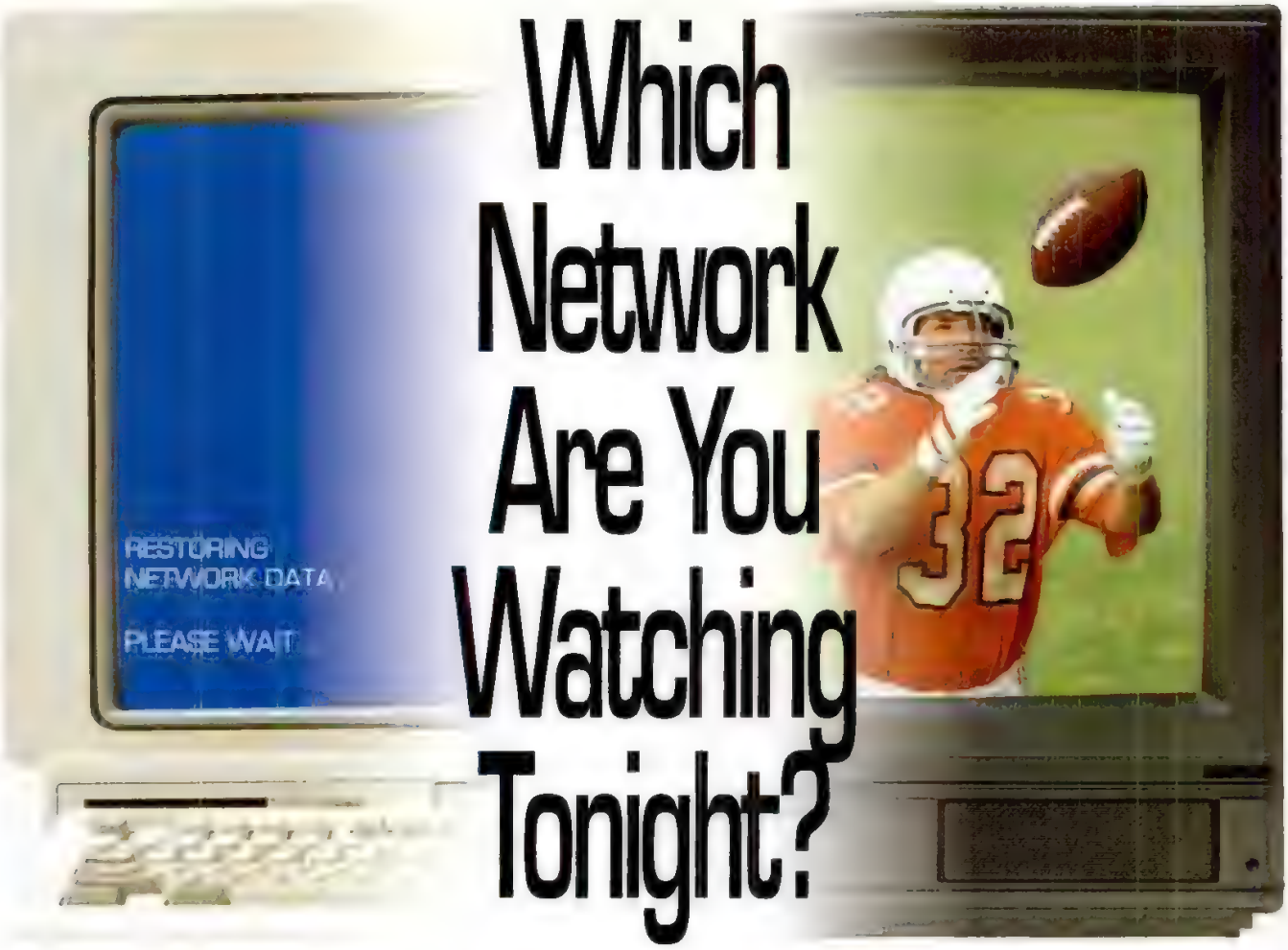


Insight 486-33 EISA
Insight Computers, 1912 W. Fourth St., Tempe, AZ 85281; 800-776-7600, 602-350-1176.
List price (tested configuration): $9,995.
Memory and processor RAM cache: 16MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Seagate 15-ms. 1.05GB SCSI hard disk, Mylex controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,280-by-1,024 adapter with 1MB RAM, ViewSonic 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: Insight Computers gained points for sending its Insight 486-33 EISA with a variety of storage options—1.05GB of storage, a tape backup drive, and a CD-ROM drive. This configuration (with its three separate controllers) left us one slot short in terms of our four network cards, however. Once we removed a controller to make room, the system performed well.

CIRCLE 506 ON READER SERVICE CARD



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CIRCLE 021 ON READER SERVICE CARD

vice. The system is not Novell certified, and the collection of manuals isn't as comprehensive as it might be.

In the final analysis, you get what you pay for. Insight's specialty is combining parts, not fine-tuning systems. The price may be right, and the Insight 486-33 EISA performs well enough to manage a network, but we would recommend a configuration that allows more space for your network adapters.

MICRO EXPRESS

ME 486-EISA/33

BY JOSEPH DESPOSITO Average performance, aggressive pricing, Novell certification, and no problems during setup marked the ME 486-EISA/33 that Micro Express sent PC Magazine Labs.

Micro Express equipped its ME 486-EISA/33 with one 1.2GB Micropolis 1598 hard disk rated at 14 milliseconds, a DPT bus-mastering SCSI caching controller (which includes a daughterboard with 4MB of RAM), a floppy I/O board, a Micro Express Extended VGA card, and a low-radiation multiscanning monitor from TVM. It lacked, however, mirrored disk drives, which cost an additional $2,500. Drive arrays are not available.

The video card is capable of noninterlaced 1,024-by-768 resolution at 72 Hz, and the monitor can display noninterlaced 800-by-600 resolution at 60 Hz. A 375-watt power supply keeps the components running, and two fans at the bottom front keep them cool.

The ME 486-EISA/33 we tested had a Micronics motherboard that held 16MB of RAM (expandable to 64MB) rated at 70 nanoseconds and 256K of 20-ns. RAM cache (the maximum amount of cache the board can hold). But after you fill the motherboard's eight expansion slots with the DTP controller, the video card, and the combination I/O and floppy disk controller card, and then count the four Token-Ring boards we put in for testing, only one slot remains free. You also need to set two eight-position DIP switches on the motherboard.

The ME 486-EISA/33's tower case has four wheels at its base. Drive bays inside the case can accommodate eight half-height drives. To gain access to the hard disks and the floppy disk drives, you open a front panel, which is designed like a door. Right and left side panels also open out like doors; their hinges, however, are actually tabs set into slots at the back of the case—not a sturdy setup.

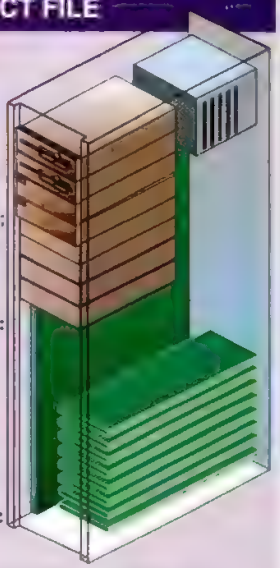
The PC Magazine Labs staff encountered no problems when setting up the system. Once set up, however, the ME 486-EISA/33 yielded server utilization scores that were a few percentage points worse than average.

The ME 486-EISA/33 is Novell certified, and the company says it will design and install your network. Micro Express handles network support through its technical support lines (Monday to Friday, 8:00 to 5:30 P.S.T.). Micro Express expects to have extended support to 24 hours a day, seven days a week by the time this review is in print. Unlike most other companies, Micro Express offers a two-year warranty on parts and labor, as well as a 30-day money-back guarantee. On-site service from TRW is an extra $50.

At $6,999, which includes a Token-Ring board that sells for about $500, the ME 486-EISA/33 is one of the lower-priced systems reviewed here. Micro Express also sells *NetWare:* A 100-user package costs $4,999.

Micro Express's ME 486-EISA/33 falls short of the mark in terms of LAN performance but does well in other areas. The server is Novell cer-

FACT FILE



ME 486-EISA/33
Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900, 714-852-1400.
List price (tested configuration): $6,999.
Memory and processor RAM cache: 16MB 70-ns. SIMMs, 256K cache.
Disk drives and controller: Micropolis 14-ms. 1.2GB SCSI hard disk, DPT controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Micro Express 1,024-by-768 adapter with 1MB RAM, TVM 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The ME 486-EISA/33 that Micro Express configured for PC Magazine Labs turned in average LAN performance times. Aggressive pricing and Novell certification give this product some appeal.

CIRCLE 507 ON READER SERVICE CARD

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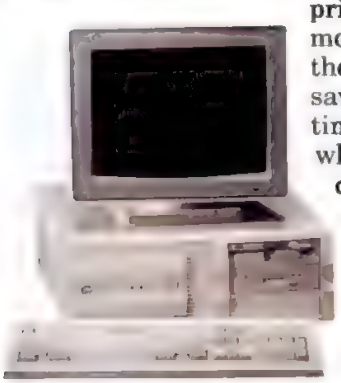

The Swan 386SX, 386/25, 38633M and 486SX all come in our new Small Footprint Baby AT case for economy of workspace.

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"As with all the Swan Technologies machines, the 486SX is solidly made and comes with an excellent service and support policy...performance and expansion room complete the picture. Swan has earned a reputation for manufacturing highly reliable systems; the 486SX's construction and support only enhance that reputation...a solid choice as a personal system for home or office..."

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- 5.25" or 3.5" Floppy Drive
- 101–Key Keyboard
- Ports: 2 Serial, 1 Parallel
- 7 Slots: 6) 16–Bit, 1) 8–Bit

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50MB Performance System

- Intel 80386SX–20™ System
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- VGA (1024 x 768) Monitor
- 1MB VGA Palette Plus Card
- 5.25" and 3.5" Floppies
- Swan Mouse & Mousepad
- 101–Key Keyboard
- Windows 3.0
- DOS 5.0

$1795

100MB Power System

- Same features as above with 4MB RAM and 100MB hard drive

$2095

Swan 386/25

- Intel 80386DX–25™ System
- 1MB RAM
- 50MB 17ms IDE Drive
- 12" Monochrome Monitor
- 5.25" or 3.5" Floppy Drive
- 101–Key Keyboard
- Ports: 2 Serial, 1 Parallel
- 8 Slots: 6) 16–Bit, 2) 8–Bit

$1285

50MB Performance System

- Intel 80386DX–25™ System
- 2MB RAM
- 50MB 17ms IDE Drive
- VGA (1024 x 768) Monitor
- 1MB VGA Palette Plus Card
- 5.25" and 3.5" Floppies
- Swan Mouse & Mousepad
- 101–Key Keyboard
- Windows 3.0
- DOS 5.0

$1945

100MB Power System

- Same features as above with 4MB RAM and 100MB hard drive

$2245

Swan 486SX/25

- Intel i486SX–25™ System
- 4MB RAM, 8K Internal Cache
- 50MB 17ms IDE Drive
- 12" Monochrome Monitor
- 5.25" & 3.5" Floppy Drives
- 101–Key Keyboard
- Ports: 2 Serial, 1 Parallel
- 8 Expansion Slots
- DOS 5.0

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120MB Performance System

- Intel i486SX–25™ System
- 4MB RAM, 8K Internal Cache
- 120MB 15ms IDE Drive
- VGA (1024 x 768) Monitor
- 1MB VGA Palette Plus Card
- 5.25" and 3.5" Floppies
- Swan Mouse & Mousepad
- 101–Key Keyboard
- Windows 3.0
- DOS 5.0

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220MB Power System

- Same features as above with 220MB 12.6ms hard drive

$3045

Swan 486/33

- Intel i486–33™ System
- 4MB RAM, 64K SRAM Cache
- 120MB 17ms IDE Drive
- 12" Monochrome Monitor
- 5.25" & 3.5" Floppy Drives
- 101–Key Keyboard
- Ports: 2 Serial, 1 Parallel
- 8) 16–Bit Expansion Slots
- DOS 5.0

$2435

120MB Performance System

- Intel i486–33™ System
- 4MB RAM, 64K SRAM Cache
- 120MB 15ms IDE Drive
- VGA (1024 x 768) Monitor
- 1MB VGA Palette Plus Card
- 5.25" and 3.5" Floppies
- Swan Mouse & Mousepad
- 101–Key Keyboard
- Windows 3.0
- DOS 5.0

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220MB Power System

- Same features as above with 220MB 12.6ms hard drive and 8MB RAM

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Swan 486/33E

- Intel i486–33™ System
- EISA Systemboard With 4MB RAM, Expandable to 64MB
- 8K Internal Cache, 128K External Cache Standard, Expandable to 256K
- 120MB 17ms IDE Drive
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- Flash EPROM Support for End–User BIOS Upgrades
- Shadow RAM for Video and BIOS
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- 200 Watt Power Supply
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COMPUTER SHOPPER "Swan Technologies is wringing thunder and lightning out of the (486) chip... silently ridiculing 486 machines that are less well endowed or can't match Swan's price."

October 1990

PC MAGAZINE "Swan's engineers clearly demonstrated that the time of building PC's with whatever parts are cheapest is over."

Bill Machrone, Editor–in–Chief,
September 11, 1990

PC Sources "Not only does it (386/25) look good, the small board uses the latest, most reliable design and manufacturing techniques...it's faster than other uncached machines tested."

November 1990

INFO WORLD "Combining Swan's price with its overall scores makes it a very good value."

July 2, 1990

PC MAGAZINE "Swan has earned a reputation for manufacturing highly reliable systems...and (Swan's) support policies only enhance that reputation."

December 31, 1991

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tified and presented no setup problems. Keep in mind, however, that mirrored drives are not offered in this particular configuration.

NATIONAL MICRO SYSTEMS INC.

Flash Server 486-33 EISA

BY WENDY DUGAS PÉREZ National Micro Systems decided that bigger is better when it designed its Flash Server 486-33 EISA. Set on wheels to make moving it easier, this 33-MHz 486-based EISA arrived in a tower case that costs $500 extra but can hold 12 5.25-inch drives. If you are looking for hard disk space, you need look no further.

The $5,101 system we tested came equipped with 16MB of RAM, a 256K direct-mapped, posted write-through cache, a 760MB 11.9-millisecond Seagate SCSI hard disk regulated by a DPT caching controller with 4.5MB of RAM, a Hercules monitor and card, and both a 1.2MB and a 1.44MB floppy disk drive.

Both the motherboard and the external cache controller are from Advanced Integration Research (AIR). The motherboard, which came with 16MB of RAM in 4MB 70-nanosecond SIMMs, can hold 12 more 4MB SIMMs, for a system total of 64MB. A Phoenix BIOS shadows both video and system memory. One parallel and two serial ports are integrated onto the motherboard, which also has a socket for a Weitek coprocessor.

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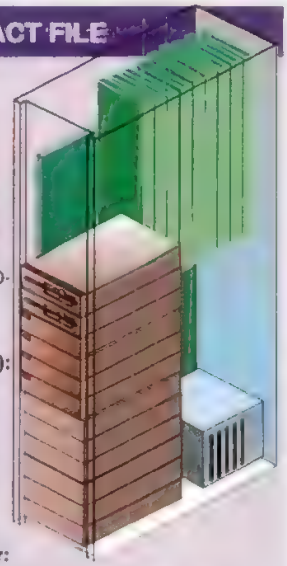

Flash Server 486-33 EISA National Micro Systems Inc., 2979-B Pacific Dr., Norcross, GA 30071; 800-642-7649.
List price (tested configuration): $5,101.
Memory and processor RAM cache: 16MB 70-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 11.9-ms. 760MB SCSI hard disk, DPT controller with 4.5MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: National Micro Systems Hercules adapter with 16K RAM, Intra 14-inch monitor.
Monitor refresh rate: Not applicable.
Software: DOS 5.0.
In Short: The Flash Server 486-33 EISA is the least expensive server in our roundup, yet it still provides ample storage and memory, along with room for 12 drives and 8 EISA cards. The system came with one 760MB hard disk, so if you want data redundancy, you will have to purchase a second hard disk.

CIRCLE 508 ON READER SERVICE CARD

Four of the Flash Server's eight 32-bit EISA slots were filled by a video board, a floppy disk controller, and a hard disk controller that took up two slots because of its cache memory. This left just enough space for our four NICs.

Of the Flash Server's 12 drive bays, 6 are front accessible. A removable side panel and a spacious internal arrangement makes it easy to reach components. To make life still easier, the Flash Server makes use of a design we have seen on larger servers: All cable connections to the cards are made through the top of the unit, which eliminates the blind search for a connector in the back. Besides the fan on the 300-watt power supply, two fans inside the case provide ventilation.

National Micro Systems' hard disks range from an 80MB IDE unit to a 1GB SCSI unit. Tape backup drives are priced from $300 for 20MB to $700 for 500MB. And if your needs outgrow the Flash Server's 33-MHz processor, you can upgrade to 50 MHz for $1,500. Smaller case options are also available for those who don't need such a large server.

The Flash Server's disk performance on PC Magazine Labs' LAN benchmark tests was about as good as those of the other servers in this roundup, though its score on the Hard Disk Access Load test score was a bit worse than average.

National Micro Systems gives a two-year warranty on labor and 15 months on parts. One year of on-site service is available for an additional $100. If you're looking for a reasonably priced server with plenty of expansion room, you may have found it here.

NORTHGATE COMPUTER SYSTEMS INC.

Northgate Elegance 433e

BY BRUCE BROWN If you're disappointed by the limited number of externally accessible drive bays you find in most computers, the 33-MHz Northgate Elegance 433e EISA tower system will bring welcome relief.

The Elegance has eight 5.25-inch half-height bays, all of which can use removable media. It's not just the eight bays that make this machine special, however. A hard disk controller designed specifically to work with *NetWare;* plenty of memory- and board-expansion capacity; a hefty, cool, and quiet power supply; and Northgate's focus on network-specific support all make the Elegance an excellent choice as a Novell file server.

The $7,449 test machine came with 32MB of RAM (the maximum), the standard 128K RAM cache, a 676MB 16-millisecond formatted full-height Maxtor SCSI hard disk, both a 1.2MB and a 1.44MB floppy disk drive, and a Ciprico *NetWare*-aware SCSI hard disk controller. Also included in the test configuration were a monochrome video adapter and a 14-inch monochrome display, five ports (two parallel, two serial, and a PS/2 mouse port), and DOS 5.0.

The Ciprico hard disk controller uses circuitry, software drivers, and NCR

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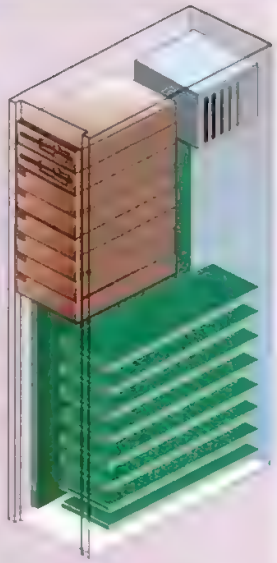
EDITORS' CHOICE



Northgate Elegance 433e
Northgate Computer Systems Inc., 7075 Flying Cloud Dr., Eden Prairie, MN 55344 800 548-1993.
List price (tested configuration): $7,449
Memory and processor RAM cache: 32MB 80-ns. SIMMs, 128K cache
Disk drives and controller: Maxtor 16-ms. 676MB SCSI hard disk. Ciprico controller, 1.2MB and 1.44MB floppy disk drives.
Display: MG-160 720-by-348 adapter, Leading Edge 14-inch monitor.
Monitor refresh rate: Not applicable.
Software: DOS 5.0.
In Short: Northgate Computer Systems wants to be your source for network hardware. The company's turnkey preinstalled networks can save you from lots of aggravation and wasted time. The Northgate Elegance 433e, with eight accessible drive bays and a network-specific hard disk controller, is a good server for its $7,449 price. Readily available network support enhances an already good product.

CIRCLE 509 ON READER SERVICE CARD

controller chip firmware, specifically designed for the way Novell uses hard disks. Novell does not benefit from hard disk controller caches, but the Ciprico controller helps provide safe and fast performance. With matched hard disks and matched Ciprico controllers (extra controllers are a $900 option), fault-tolerant duplexed systems can be configured to offer even more data safety.

Northgate's motherboard includes its own ROM BIOS to manage the Intel 486 CPU and support chip set. The motherboard includes a socket for a Weitek 4167, eight SIMM sockets for conventional row/column memory (up to 32MB maximum), and eight EISA slots, six of which can accommodate EISA bus-mastering cards. The tested system had six slots free, one for the hard disk controller card and one for the video adapter.

Because this system was configured as a file server, Northgate installed a 720-by-348-mode monochrome video card. The card has circuitry for one parallel and one serial port that, together with the motherboard's integrated ports, brought the system to its total two parallel and two serial ports. There is also a PS/2-style mouse port built-in.

The Elegance's tower case measures 24 by 7.5 by 22.3 inches. There is plenty of room inside for the eight drive bays, eight expansion-card slots, a power supply, and fans. The tested system's $200 PC Power and Cooling 450-watt Turbo power supply, which has five device connectors, delivers lots of power quietly. The power supply's integrated fan plus the set of dual fans located in the bottom front of the case keep the expansion cards cool and are a good provision for trouble-free operation.

The Northgate Elegance performed well on PC Magazine Labs' LAN benchmark tests. There were no network incompatibility problems, as there shouldn't be with this Novell-certified system. A bonus for those concerned about noisy electrical devices is the Elegance 433e's FCC Class B rating.

Northgate sells systems directly, via VARs, a company store, and a limited number of dealers. The company has established a network sales division to identify customers' network needs and then ship configured systems that are ready to run. By cutting out the time-consuming and often confusing network configuration and installation steps, Northgate hopes to attract network customers.

A definite bonus is the Northgate Elegance 433e's FCC Class B rating.

Northgate's after-sale service and support further enhances its products' attractiveness to network customers. Network support specialists are available via an 800 number 24 hours a day, seven days a week. On-site service is included with the standard one-year warranty, with service provided by NCR, which has over 400 locations nationwide.

The Northgate Elegance 433e gives you a lot for your money. The combination of good service and support for network system customers, components specifically configured for network use, and good expansion capacities make this admirable computer a fine choice as a network file server.

SAMSUNG INFORMATION SYSTEMS AMERICA INC.

Samsung System Master 486/33TE

BY PATRICK HONAN Samsung Information Systems America has taken the unusual approach of leaving system options completely up to the dealers that sell the Samsung System Master 486/33TE. As a result, the company does not offer any configurations for this machine that would be considered worthy of a network file server—no EISA controllers, no hard disks, and no *NetWare*, Version 3.11.

This approach makes it difficult to quantify pricing for the System Master, though Samsung estimated a price of $10,194 for the system that it configured exclu-

sively for *PC Magazine*. This configuration included a 676MB hard disk, an EISA SCSI controller with 4MB of cache, two floppy disk drives, and Super VGA color display.

Samsung is right in asserting that options such as the SCSI controller and large hard disks are readily available from dealers. But there is something to be said for knowing that a company stands behind a certain mix of equipment.

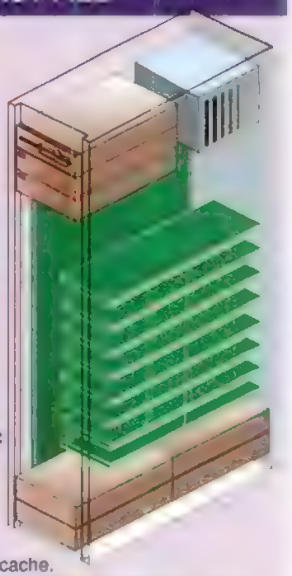
The System Master has seven standard-height 5.25-inch bays. Three of these—one fewer than most tower cases offer—are front accessible. A common server configuration with a tape drive unit and one floppy disk drive would leave just one bay open for another drive, whether it be a second floppy disk drive, a CD-ROM player, an erasable optical unit, or a removable hard disk. The video board, hard disk controller, and I/O board occupied three of the eight EISA slots, leaving five open.

The System Master uses a Samsung motherboard with an Intel chip set and a Phoenix 486 ROM BIOS. Memory expansion is more limited than on other machines. Eight SIMM sockets on the motherboard hold a system maximum of 32MB RAM in 4MB 80-nanosecond SIMMs; there is also a 128K write-back RAM cache.

Samsung backs the machine with a one-year parts-and-labor warranty. On-site service from Intelogic Trace is available as an option, with prices varying according to the number and type of units bought. The cost for one system in the standard configuration would be $155 for the first year, according to Samsung. Toll-free technical support is available Monday through Friday, from 7:00 to 5:00 P.S.T.

Unless you don't mind getting important network components elsewhere, the Samsung System Master 486/33TE is not meant to be your network server.

FACT FILE



Samsung System Master 486/33TE
Samsung Information Systems America Inc., 3655 N. First St., San Jose, CA 95134-1713; 800-624-8999 ext. 851.
List price (tested configuration): $10,194
Memory and processor RAM cache: 32MB 80-ns SIMMs, 128K cache.
Disk drives and controller: Seagate 16-ms 676MB SCSI hard disk, UltraStor controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives
Display: Samsung 1,024-by-768 adapter with 512K RAM, Samsung 14-inch monitor.
Monitor refresh rate: 60 Hz
Software: DOS 5.0
In Short: The company leaves the Samsung System Master 486/33TE's hard disk and controller options to the dealer. For this reason, the company configured a system with components it normally does not sell. Though this server performed as well as any other, Samsung is not the company for one-stop network shopping.

CIRCLE 510 ON READER SERVICE CARD

SIRIUS SYSTEMS TECHNOLOGY INC.

SST 486-33ME

BY JOSEPH DESPOSITO Sirius Systems Technology has configured an EISA network server with plenty of storage and an aggressive price. Even so, lack of Novell certification, along with some performance problems and what appeared to be a faulty power supply, might make a buyer think twice about purchasing the SST 486-33ME.

The $8,775 unit we tested came with 16MB of RAM, 64K of 15-nanosecond RAM cache, two SCSI-2 1.2GB Seagate ST41200N hard disks rated at 15 milliseconds, two UltraStor Ultra 24F bus-mastering SCSI controllers, an I/O board, a 1MB PowerGraph VGA board from STB Systems, and a multiscanning monitor from CTX International. Instead of wheels, the SST 486-33ME's tower case rests on a platform with adjustable feet.

Although the server itself is not Novell certified, SST does sell *NetWare:* $2,500 for a 20-user system and $5,000 for a 100-user system. SST offers network support through its technical support lines.

Both of the SST 486-33ME's side panels are removable, allowing you easy access to the inside. To insert or remove the front-accessible drives, however, you

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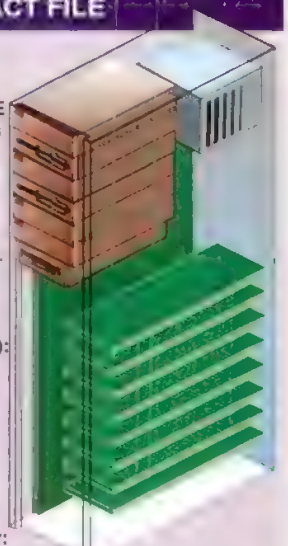

SST 486-33ME
Sirius Systems Technology Inc., 4344 Young St., Pasadena, TX 77504; 800-424-0724, 713-946-0724.
List price (tested configuration): $8,775
Memory and processor RAM cache: 16MB 70-ns SIMMs, 64K cache.
Disk drives and controller: Two Seagate 15-ms, 1.2GB SCSI hard disks, UltraStor controller, 1.2MB and 1.44MB floppy disk drives.
Display: STB Systems 1,024-by-768 adapter with 1MB RAM, CTX International 14-inch monitor.
Monitor refresh rate: 60 Hz
Software: DOS 5.0
In Short: The SST 486-33ME, priced at $8,775, includes a pair of duplexed full-height 1.2GB hard disks. Performance was poor on server utilization but good on hard disk access. Though SST sells *NetWare*, the SST 486-33ME itself is not Novell certified.

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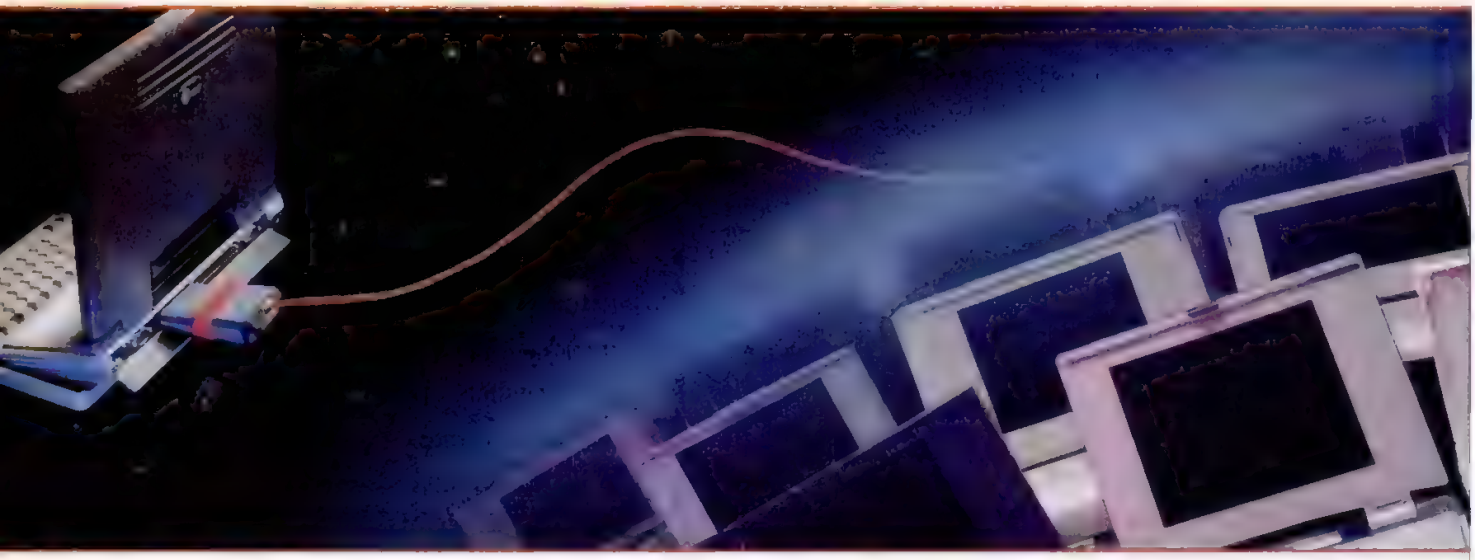

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CIRCLE 211 ON READER SERVICE CARD

simply remove the front panel. Five front-accessible drive bays (four 5.25-inch and one 3.5-inch) plus two internal 5.25-inch bays can accept either seven half-height devices or three half-heights plus two full-height devices.

The two 1.2GB full-height hard disks are duplexed. The two UltraStor controllers, however, use a 64K buffer rather than a RAM cache. Sirius does not sell disk arrays.

Both the CTX monitor and the STB VGA board can display noninterlaced 1,024-by-768 resolution at 60 Hz. With a monochrome VGA monitor, the SST 486-33ME is $350 less ($8,425). The system's 275-watt power supply failed, but a replacement unit ran fine. The problem, which SST is now addressing, was attributed to the power supply's susceptibility to temperatures below 55 degrees Fahrenheit.

You can expand the 16MB of 70-nanosecond RAM on the Micronics motherboard to a system total of 64MB; the maximum RAM cache is 256K. Once we had put in the four Token-Ring boards for testing, seven of the eight expansion slots were filled. You also need to set two eight-position DIP switches for network configuration.

Though the SST 486-33ME's Hard Disk Access Load benchmark test scores were fine for each configuration (8, 16, 24, and 31 client PCs), its server-utilization scores were the poorest of the group.

SST supports networks through its usual support lines: Monday through Saturday from 7:00 to 7:00 C.S.T. There is a one-year warranty on parts and labor; on-site service from TRW and others is free for the first year.

Because of the SST 486-33ME's mixed performance on PC Magazine Labs' LAN benchmark tests, its aggressive pricing (which includes two 1.2GB hard disks) may not be enough to carry the day.

SWAN TECHNOLOGIES

Swan 486/33E

BY JOHN R. QUAIN Those looking for good value in a file server will appreciate Swan Technologies' Swan EISA 486/33E. For $7,674, the Swan 486/33E includes 16MB of DRAM, 128K of external SRAM cache, 800MB of disk storage, two floppy disk drives, and DOS 5.0.

One reason for the modest price is a monochrome monitor with 8-bit video. Still, that tradeoff is not bad: On PC Magazine Labs' LAN benchmark tests, the Swan 486/33E matched the good performance of many higher-priced systems.

Outside, the Swan 486/33E's tower case has a flip-open door to keep dust out of the accessible drive bays and to prevent anyone from leaning on the power button and shutting down your network. Three accessible drives allow room for 1.2MB and 1.44MB floppy disk drives (included in the tested system) and a tape backup unit (an optional 700MB Colorado drive is available for $799).

Internally, the Swan 486/33E can also handle four half-height 5.25-inch hard disks, although you can make two of these front-accessible if you need extra space for removable media. That's enough to take you up to 3.2GB of storage if you so desire, although storage is not cheap: $3,299 for a 13-millisecond 1.6GB SCSI hard disk. You can add other SCSI controllers to increase fault tolerance.

The evaluation unit we received came with two 12.6-ms. 400MB Hewlett-Packard hard disks under the control of an Adaptec SCSI-2 EISA adapter. Representing the

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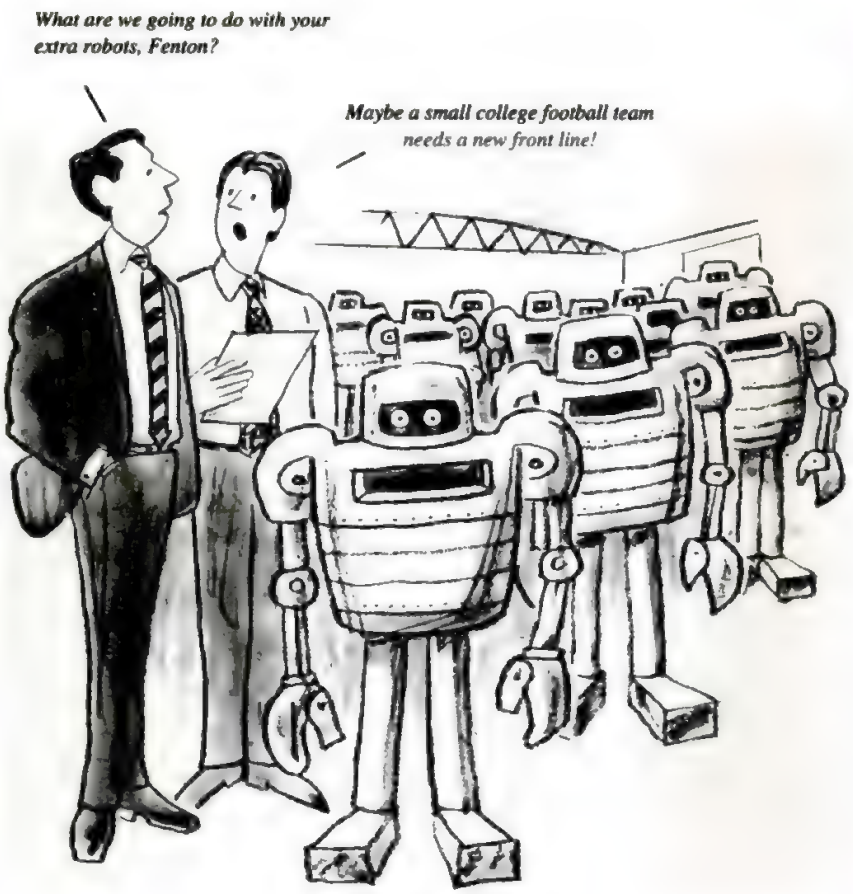

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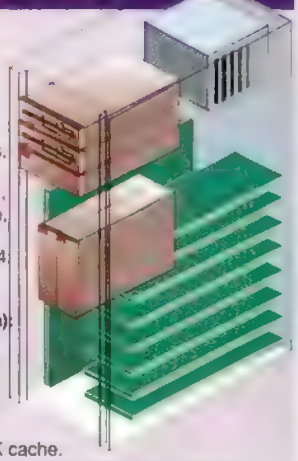
latest in storage control devices, the SCSI-2 controller is not only capable of bus mastering and EISA burst-mode transfers, it can support as many as 56 daisy-chained hard disks. Because SCSI-2 adapters don't require additional RAM caching, they also tend to be less expensive than comparable RAM-hungry standard SCSI and ESDI performers.

The Anigma-designed motherboard based on the Intel chip set does not boast the same level of integration as some other systems. Consequently, the SCSI-2 controller, IDE floppy disk controller (with parallel and serial ports), and video adapter take up three of the eight EISA slots. That left a slot to spare when we added four network cards.

The motherboard offers easy upgradability, however. The 33-MHz 486DX processor comes mounted in a ZIF (zero-insertion force) socket, allowing users to remove and upgrade the processor simply by flipping up a tiny handle on the CPU's side; you will easily be able to switch to one of Intel's 33-MHz/66-MHz dual-

FACT FILE



Swan 486/33E
Swan Technologies, 3075 Research Dr., State College, PA 16801: 800-468-9044
List price (tested configuration): $7,674.
Memory and processor RAM cache: 16MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Two Hewlett-Packard 12.6-ms. 400MB SCSI hard disks, Adaptec controller, 1.2MB and 1.44MB floppy disk drives.
Display: Cardinal monochrome adapter with 64K cache, Swan 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: System managers who have to set up small workgroup networks on a tight budget should consider the $7,674 Swan 486/33E tower. With 800MB of storage and 16MB of DRAM, the Swan 486/33E stayed with the leaders on PC Labs' LAN benchmark tests. Furthermore, the system offers the benefits of a SCSI-2 controller and the potential to upgrade to Intel's dual-clock-speed chip when it becomes available.

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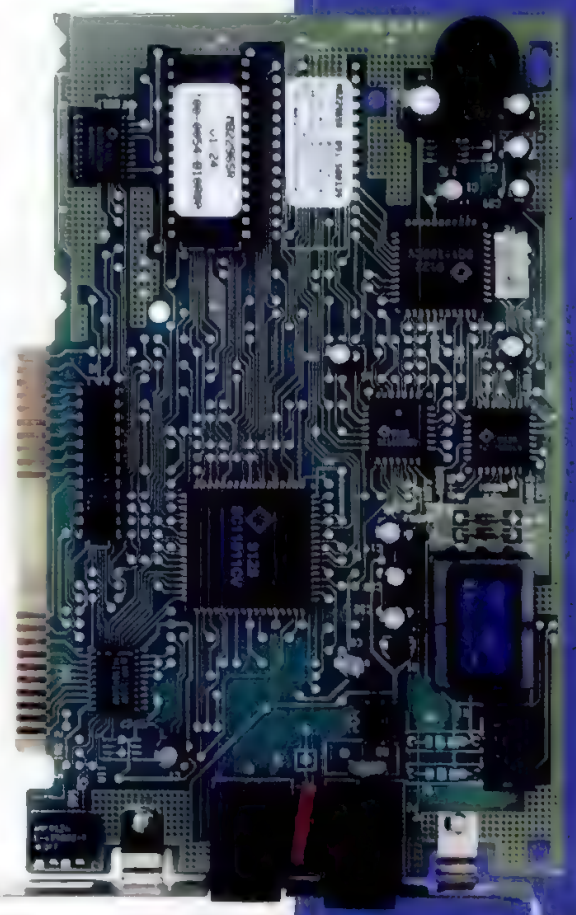

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CIRCLE 319 ON READER SERVICE CARD

clock-speed chips when they become available. Next to the processor is room for a Weitek 4167 coprocessor ($1,295). BIOS upgrades are facilitated by an Award Flash EEPROM installation program, which is protected against computer viruses and inadvertent erasure by an accompanying nonvolatile ROM BIOS.

For serious disk caching, you can raise the system memory to 64MB of DRAM. To reach the limit, though, you will have to remove the internal storage bay bracket and replace the original 4MB SIMMs with 8MB SIMMs ($95 per megabyte). A 128K external SRAM cache comes standard with the system. A proprietary SIMM socket will accommodate an additional 128K of 20-nanosecond write-back cache ($229).

For a 32-node network with four Token-Ring cards, system setup presented no special difficulties. On PC Magazine Labs' LAN benchmark tests with all 32 nodes, the Swan 486/33E exhibited no more and no less system utilization than the rest of the servers in this group. The throughput tests also demonstrated that the Swan server could keep up with the LAN heavyweights.

The Swan 486/33E proved able enough to manage all of the LAN tasks it encountered, and there is enough space between components, plenty of ventilation for network cards, and enough power (320 watts) to run a full complement of EISA expansion cards. Access to the interior is slightly difficult—you will need to turn the system on its side—but most LAN managers should be happy with the performance this tower will give.

In keeping with its frugal nature, and based on the reasonable assumption that the server will remain unattended for the most part, our test system came with a simple 12-inch amber monochrome monitor and an 8-bit monochrome video adapter. At press time, the Swan 486/33E's Novell certification was pending, as was its FCC Class B approval. To keep the prospect of mail-ordering a file server from setting your teeth on edge, Swan covers its systems with toll-free technical support seven days a week (weekdays from 9:00 to 9:00 E.S.T. and weekends from 9:00 to 5:00) and a two-year on-site parts-and-labor warranty.

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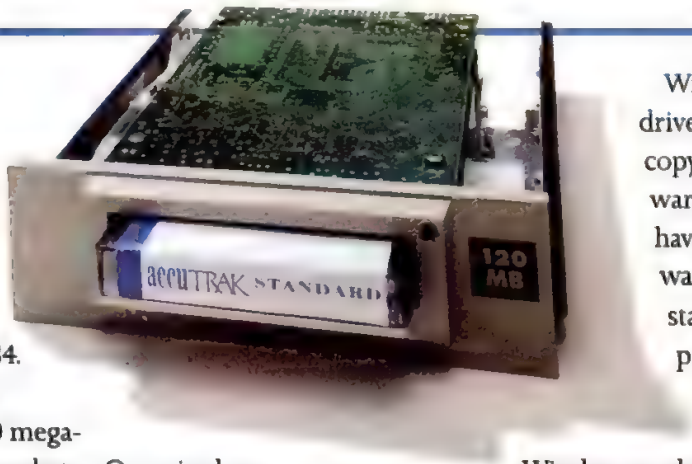

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SYSTEMS INTEGRATION ASSOCIATES

SIA 486/33E

BY GREG PASTRICK The SIA 486/33E has the look and feel of a network administrator's dream machine. It's a noticeably well-designed system inside and out, from its rotated system board placement, which allows unrestricted access to all installable slots and sockets, to a smartly styled and absolutely secure heavy-gauge alloy case. A substantial piece of equipment by any measure, it comes at a substantial price.

As configured to handle a 32-node network for our tests, the SIA costs $16,745. Though this system looks expensive at first glance, it was also one of the most heartily configured PCs in this review; with more than 3GB of storage, 32MB of RAM, and a color VGA display subsystem.

The unit is powered by a 450-watt power supply, and all components are connected to a Mylex motherboard with eight bus-mastered 32-bit EISA slots. What's more, everything is buttoned up tighter than a tank behind removable top and side panels and a hinged front cabinet door. The lock on the door prevents unauthorized access not only to the stacked drive bays but also to the control panel, with its power, reset, and keyboard disable switches.

The system came to us with two half-height and four full-height drives installed; alternatively, you could configure it with ten half-height drives. More than half the price and most of this system's weight is devoted to the quadruplet Seagate SCSI-1 hard disks, which have a formatted capacity of 675MB each. Twin Mylex DCE376 caching EISA SCSI host adapters manage the disk duplexing on the system. These bus-mastering devices also control the Fujitsu and Toshiba floppy disk drives delivered with the system; you may configure each with up to 8MB of static RAM cache.

Though the system came with *NetWare*, Version 3.11, and DOS 5.0 already installed, drive setup for *NetWare* operation requires you to copy the EISA configuration files and *NetWare* adapter drivers to the appropriate subdirectories, and then run the EISA setup and Novell installation routines. In addition to the system's two Mylex disk-controller

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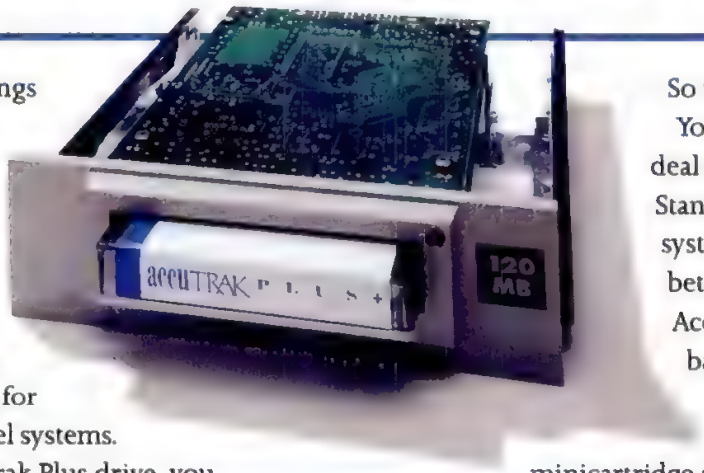

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cards, video, and I/O, we installed four Token-Ring cards that filled the remaining slots.

The Mylex system board is rotated 90 degrees, allowing you to access all external ports and adapters from the top of the machine. A protective panel, removable only when the cabinet door is open, slides on top of the case, making the extra-long keyboard and display extension cables that come with the system a necessity. But inside the chassis, all slots and sockets for expansion cards, system and cache memory, and the coprocessor are absolutely free and clear of obstruction.

The installed system board holds a maximum of 32MB of RAM, and there are no provisions for memory expansion beyond that.

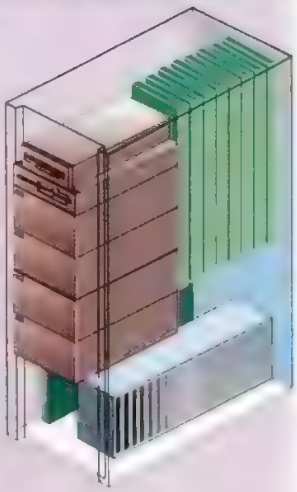
Future system boards in SIA units will hold up to 126MB of memory on-board. In addition, the banked interleaved external static RAM caching is controlled by a proprietary chip, and SIA plans to allow expansion beyond the 128K maximum on the current motherboard.

System setup is based on standard EISA configuration software and the CMOS contents of the unit's Mylex 486 EISA BIOS. The system setup has an extended range of features and options, including primary and secondary cache enabling, system diagnostics, and error-trapping routines. Support is assured for a variety of operating systems and networking software.

The company supplies a unique if somewhat expensive attachment to the SIA tower. As an adjunct to the system's two cooling fans, a $4,112 air-conditioning unit may be mounted on the rear of the machine. The air conditioner circulates internal air by drawing heat from hot metal to cool metal. Thermoelectric modules located at the back and top of the system keep the temperature constant. The 46-pound unit is designed to seal out dusty, hot, humid environments and automatically shuts down the system with advance warning if the temperature exceeds a safe operating range.

SIA supplies its high-end systems, which include a rack-mounted version of the tested unit for an additional $400, through VAR/OEM channels only. As such, pricing of options and enhancements are subject to dealer negotiations. Though its products are backed by a one-year warranty, service and support options are also subject to conditions set by authorized dealers. Any way you cut it, you'll pay premium price for a premium server that has rugged, secure network performance and a functional, appealing design.

FACT FILE
EDITORS' CHOICE



SIA 486/33E
Systems Integration Associates, 222 E. Pearson St., #502, Chicago, IL 60611; 312-440-1275.
List price (tested configuration): $16,745.
Memory and processor RAM cache: 32MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Four Seagate 15-ms. 766MB SCSI hard disks, two Mylex controllers with 8MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond Super VGA adapter with 1MB RAM, Relysis 14-inch monitor.
Monitor refresh rate: 70 Hz.
Software: DOS 5.0.
In Short: Systems Integration Associates' SIA 486/33E tower is a premium server offered at premium prices. Its strong, secure design is ideal for network operation in rugged or sensitive environments. This PC is also a very stylish and functional system with enough mass-storage space, cooling, and power wattage to build a showcase server. In addition, completely unobstructed access to motherboard slots and sockets make this a network administrator's machine.

CIRCLE 511 ON READER SERVICE CARD

TANGENT COMPUTER INC.

Tangent Model 433e

BY JOSEPH DESPOSITO Excellent performance and aggressive pricing make the Tangent Model 433e a system worth your consideration.

The $7,838 server came equipped with two 339MB Seagate ST1401N hard disks rated at 12 milliseconds, a Mylex DCE 376 bus-mastering SCSI caching controller with 4MB of RAM, an I/O board, a monochrome monitor from Samsung, and a Hercules-compatible monochrome/graphics adapter from Diamond Flower. With the drives unmirrored, total disk capacity is 678MB; mirroring, which is possible in this configuration, would cut that in half but gives a degree of redundancy. The Model 433e is powered by a 300-watt Turbo-Cool power supply from PC Power and Cooling. Another option is a 550-watt power supply with specially modified fans.

The Model 433e uses the Mylex MNE-series EISA motherboard. According to the vendor, this board runs 15 to 20 percent faster than the Mylex MAE-series board (which is used in systems such as the Zeos 486-33E), though our tests did not pick up this difference. The motherboard's 16MB of 60-nanosecond RAM is expandable to 32MB, while many systems in this roundup could support 64MB. The board's maximum amount of RAM cache is 128K, rated at 15 ns. Only one of the eight expansion slots on the motherboard was available after we added four Token-Ring boards to the system.

The tower case of the Model 433e has two wheels at its base and a handle at the

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☐ 3½" format available from us. Specify when ordering.
▣ package includes both 5¼" and 3½" disks.
⊡ 3½" format available from manufacturer by request. Call us for details.
CP—copy-protected; NCP—not copy-protected.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

SOFTWARE

We carry only the latest versions of products. Version numbers are current at press time. Products listed here in red are Microsoft Windows Applications.

AddStor ... NCP
4090 ▣SuperStor 1.3 ... $83.

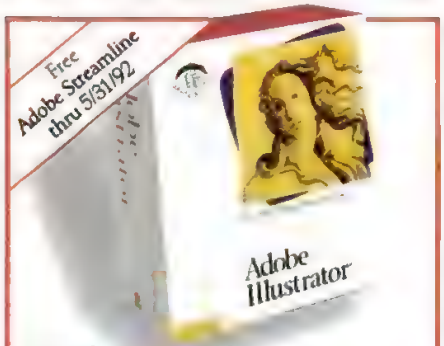
Adobe Systems ... NCP
7547 ▣Adobe Type Manager 2.0 for Windows . 69
9623 ▣Adobe TypeAlign 1.0 for Windows 69
6591 ▣Adobe Illustrator 4.0 for Windows 429
▣Adobe TypeSets for Business ..... ea. 95
9874 ▣Adobe TypeAlign 1.0 with ATM ..... 125.
6590 ▣Adobe Streamline 3.0 for Windows ... 125
7928 ▣Adobe Plus Pack 1.0 ... 129
8367 ▣ATM & Plus Pack Bundle ... 169
▣Adobe PostScript Cartridge *(with choice of FREE Type Cartridge 1 or Type Cartridge 2)* 239
(Entire Adobe Type Library, from 1 to 240 is available. Call for more information.)

Aldus ... NCP
8000 ☐Persuasion 2.0 for Windows ... 359
1332 ☐PageMaker 4.0 ... 549
4195 ☐Photostyler 1.0 ... 549

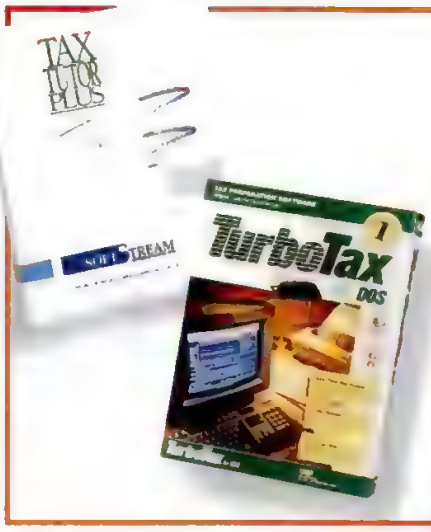
Alpha Software ... NCP
5104 ▣Alpha FOUR 2.0 *(multi-user edition with free LAN 2-pack)* ... 299.

Application Techniques ... NCP
1214 ▣Pizazz Plus 2.0 ... 69
9621 ▣Picture Eze 1.0 for Windows ... 99

Artisoft ... NCP
2455 Lantastic EtherNet Starter Kit *(includes software, 2 EtherNet cards, cable)* ... 495.
2452 EtherNet Adapter Card ... 199.



Adobe Systems ... NCP
1598 ▣*Adobe Illustrator 4.0 for Windows*—Now includes Adobe Type Manager, TypeAlign, Separator, 40 Adobe typefaces & a selection of Adobe patterns, textures, symbols & borders from the Adobe Collector's Editions... $429.



Chipsoft & SoftStream Int'l. ... NCP
1663 ▣*TurboTax Personal 1040 9.0 for DOS*—TurboTax, America's best selling tax software for the PC, features over 80 forms, schedules and worksheets plus a tax planning module. Prints IRS-approved returns ... $49.
3517 ▣*TurboTax Personal 1040 9.0 for Windows* 59.

1054 ▣*Tax Tutor Plus*—Answers your tax questions, teaches fundamental tax-saving strategies and offers advice you can access instantly via "hypertext" cross-referencing, keyword searching or subject menus .... 49.

5366 ▣*TurboTax Personal 1040 9.0 for DOS & Tax Tutor Plus Bundle* ... 82.

Atech Software ... NCP
9436 ☐Publisher's Powerpak 1.2 for Windows . 49.
9435 ☐Publisher's Powerpak 2.1 for WordPerfect & Microsoft Word ... 49.
4797 ▣AllType 1.0 *(universal typeface converter)* 49.

Attitash Software ... NCP
8846 ▣WideAngle 2.0 ... 79

Automap ... NCP
2729 ☐Automap 1.0 ... 52.

Avery Dennison ... NCP
6006 ▣Label Pro 1.6 *(Laser)* ... 49.
7336 ▣Label Pro 1.0 for Dot Matrix ... 49.

Banner Blue Software ... NCP
3322 ▣Family Tree Maker 2.0 ... 45.
3324 ▣Org Plus Advanced 6.0 ... 65.
2088 ▣Org Plus for Windows 1.0 ... 125.

Berkeley Systems ... NCP
9885 ▣After Dark 2.0 for Windows ... 29.

Bitstream ... NCP
7568 ▣FaceLift 1.2 for Windows 2.x/3.0 ... 59
8040 ▣FaceLift 1.5 for WordPerfect 5.0/5.1 ... 59.
2089 ▣MakeUp 1.0 for Windows 3.0/3.1 ... 95.
7569 ▣Companion Value Pack 1.0 ... 125.
▣Typeface Packages ... ea. 89.

Borland International ... NCP
3551 ▣Quattro Pro SE 1.0 ... 47
6242 ▣Quattro Pro 3.0 ... 339.
7030 ☐Quattro Pro 3.0 Competitive Upgrade . 95.
9695 ☐Borland's C++ 2.0 ... 339.
1514 ▣Paradox 3.5 ... 529.
7988 ☐Paradox 3.5 Competitive Upgrade ... 165.
9635 ▣Object Vision 2.0 ... call

Broderbund ... NCP
1434 ▣New Print Shop ... 39.

ButtonWare ... NCP
6419 ▣PC-File 6.0 ... 89.

Caere ... NCP
8933 ▣Omnipage Professional 1.0 ... 669

Campbell ... NCP
5068 ▣On Time for Windows 1.0 ... 75.

Central Point ... NCP
5039 ☐PC Tools 7.1 ... 115.
6179 ☐PC Tools Deluxe LAN 7.1 ... 799.
8114 ▣Backup 7.0 *(DOS and Windows)* ... 84.
9751 ▣AntiVirus 1.0 ... 84.

Chipsoft ... NCP
1663 ▣TurboTax Personal 1040 9.0 for DOS .. 49.
5366 ▣TurboTax Personal 1040 9.0 for DOS & Tax Tutor Plus Bundle ... 82
3517 ▣TurboTax Personal 1040 9.0 for Windows 59
State Tax Packages
DOS ver... ea. 38. Windows ver... ea. 49.
▣ShortForm *(for 1040 & E-Z filers)*
3788 DOS ver. ... 25. 3782 Windows ver. ... 25.
6221 ▣TurboTax Personal 1040 9.0 for DOS & Quicken Bundle ... 75.
3080 ▣TurboTax Personal 1040 9.0 for Windows & Quicken for Windows Bundle ... 75.

Chronologic Corporation ... NCP
8849 ▣Instant Recall 1.2 ... 64.

CompuServe ... NCP
7546 ▣DOS Membership Kit 1.3 ... 29.

Concentric Data Systems ... NCP
6575 ▣R & R Relational Report Writer 4.0 ... 159.

Contact Software ... NCP
1625 ▣Act! 2.1 ... 229.

Corel Systems ... NCP
5506 ☐CorelDRAW! 2.0 ... 379.
2618 CorelDRAW! 2.0 CD-ROM . 449.

DAC Easy ... NCP
1748 ▣Accounting 4.2 ... 99.
1751 ▣Bonus Pack 4.2 ... 129.

Data Storm ... NCP
4798 ▣PROCOMM PLUS 2.01 ... 69.

Delrina Technology ... NCP
2446 ▣WinFaxPro 2.0 ... 75.
7351 ▣PerFORMPRO 1.0 ... 179

Digital Research ... NCP
8288 ☐DR DOS 6.0 ... 69.

Discovery Systems ... NCP
3215 Nautilus Subscription Kit *(CD-ROM)* ... 20.

Fifth Generation Systems ... NCP
7725 ▣Direct Access 5.1 ... 69.
3950 ▣Fastback Plus 3.0 ... 125.

Fox Software ... NCP
6188 ⊡FoxPro 2.0 ... 489.

Funk Software ... NCP
9488 ▣Sideways 3.3 & P.D. Queue 1.0 ... 85.

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5217 ☐Geoworks Pro ... 129.

Bitstream ... NCP
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9832 ▣ SpinRite II 2.0 ... 64.
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3978 ☐ One-Write Plus Accounting 1.0 *(with free MECA TaxCut)* ... 105.
4880 ☐ One-Write Plus Acct Works 1.0 ... 189.
Helix Software ... NCP
9627 ▣ Netroom 2.1 *(single user)* ... 65.
IBM ... NCP
2666 ☐ DOS 5.0 Upgrade ... 59.
Individual Software ... NCP
1328 ▣ Professor Windows 1.0 ... 27.
6222 ▣ Resume Maker 1.3 ... 29
Inset Systems ... NCP
7298 ▣ HiJaak 2.1 ... 99.
7300 ▣ Inset Plus HiJaak ... 125.
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2426 ▣ Quicken 5.0 ... 45.
5596 ▣ Quicken for Windows 1.0 ... 45
2474 ▣ Quicken with QuickPay ... 75.
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2656 ▣ Printer Control Panel 2.2 ... 99
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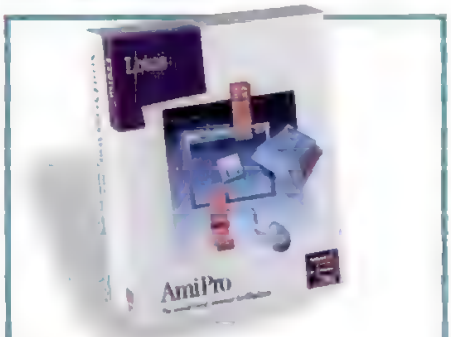
2755 ☐ 1-2-3 for Windows 1.0 ... 399
5799 ▣ Ami Pro 2.0 ... 299
1847 ▣ Ami Pro Competitive Upgrade ... 95
3523 ▣ Freelance for Windows 1.0 ... 349
2750 ▣ cc:mail DOS Platform Pack ... 125
2748 ▣ cc:mail Windows Platform Pack ... 325
2749 ▣ cc:mail 25 user Pack ... 379.
M-USA Business Systems ... NCP
3408 ▣ Pacioli 2000 *(Accounting software)* ... 35
MacroMind•Paracomp ... NCP
3484 ☐ Action! 1.0 ... 349
MECA ... NCP
2798 ☐ Managing Your Money 8.0 ... 109.
4603 ▣ Tobias' Tax Cut 1040 1991 ... 49
Microcom ... NCP
4408 ▣ Micro Courier 1.0 ... 59
7649 ▣ Virex-PC 2.0 ... 79
6234 ▣ CarbonCopy Plus 6.0 ... 119.
4410 ▣ CarbonCopy Plus for Windows ... 119
Micrografx ... NCP
3627 ☐ Windows Draw! 3.0 ... 95
Micro Logic Software ... NCP
8579 ▣ MoreFonts 3.0 ... 75.



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Microsoft ... NCP
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7010 ☐ Windows 3.0 ... 99.
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2904 ☐ Works 2.0 ... 99.
2735 ▣ Works 1.0 for Windows ... 139.
3337 ▣ Publisher 1.0 for Windows ... 139.
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4925 ▣ *PackRat 4.0*—Increase productivity by easily managing your business and personal information. Handle your phone book, calendar, to-do's, projects, free-form notes and much more! ... $249.

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4925 ▣ PC-Kwik Power Pak 2.1 ... 75
Nolo Press ... NCP
5122 ▣ For The Record 2.0 ... 35.
2982 ▣ WillMaker 4.0 ... 39
Norton-Lambert ... NCP
2753 ☐ CloseUp for Windows & DOS Dual Pack ... 129
Novell ... NCP
4000 ☐ Netware Lite 1.0 ... 69
Okna ... NCP
9696 ▣ Desktop Set 3.0 for Windows ... 85
PC Globe ... NCP
5902 ▣ PC Globe 4.0 ... 45.
5900 ▣ PC USA 2.0 ... 35
Personics ... NCP
9288 Laptop Ultravision 2.1 *(3½" only)* ... 49.
4384 ▣ Ultravision 2.0 ... 79.
Polaris Software ... NCP
4395 ▣ PackRat 4.0 ... 249
PowerUp! ... NCP
7860 ▣ Calendar Creator Plus 4.0 ... 52.
7857 ▣ Labels Unlimited 3.0 ... 59.
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7539 ☐ 386MAX 6.0 ... 65.
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3221 ☐ Expanded Memory Mgr. 386 6.0 ... 59.
4586 ☐ DESQView 386 2.4 ... 135.
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4155 ▣ RightWriter 4.0 ... 54.
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7891 ▣ WealthStarter 2.0 w/Charles J. Givens ... 39.
6572 ▣ WealthBuilder 1.1 ... 99.
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7483 ▣ Grammatik for Windows 2.0 ... 59
Roykore ... NCP
2473 ▣ Instant ORG Charting! 1.0 ... 125
8162 ▣ ABC Flowcharter 1.1 ... 189
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9638 ☐ Professional Write Plus 1.0 ... 169
4389 ☐ Harvard Draw 1.0 ... 429.
3482 ☐ Harvard Graphics 3.0 ... 419.
4403 ☐ Harvard Graphics 1.0 for Windows ... 419
6600 ▣ Superbase 4 for Windows 1.3 ... 529
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9859 ▣ Word for Word 4.2 for Windows ... 47
3290 ▣ Desk Reference Library ... 45.

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Symantec ... NCP
6397 ☐ The Norton Backup 1.2 *(Windows/DOS)* 89.
3146 ☐ The Norton Utilities 6.0 ..... 119.
3425 ☐ Q&A 4.0 ..... 269.
7999 ☐ Norton Anti-Virus 1.5 ..... 89.
2359 ☐ The Norton Desktop 1.0 for Windows .. 99.
8378 ☐ PC Anywhere IV 4.5 ..... 125.
4688 ☐ Zortech C++ 3.0 ..... 479.
Systems Compatibility ... NCP
9046 ☐ Complete Writer's Toolkit 1.1 *(DOS)* ... 85.
3949 ☐ Complete Writer's Toolkit 1.0 for Windows 85.
Teleware ... NCP
9847 ▣ M Y O B for Windows 139.
TIMESLIPS ... NCP
6994 ☐ PercentEdge 1.0 ..... 69.
2987 ☐ Timeslips III 4.0 ..... 195.
5037 ☐ TimeSheet Pro for Windows 135
Timeworks ... NCP
6253 ▣ Publish-It! 2.0 ..... 159.
Tool Technology ... NCP
3863 WinTools for Windows 1.0 *(3½" only)* 125
Touchstone Software ... NCP
7420 ▣ Check It 3.0 ..... 89.
Traveling Software ... NCP
4407 ▣ LapLink Pro 4.0 ..... 95.

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4214 ▣ WordPerfect Office PC ..... 89.
3804 ☐ WordPerfect 5.1 ..... 269.
3494 ☐ WordPerfect 5.1 for Windows 279
3806 ☐ WordPerfect 5.1 Additional User 199
WordStar International ... NCP
1482 ▣ Correct Grammar 1.0 for Windows 65
3442 ▣ WordStar 1.0 for Windows 279
XTREE ... NCP
6161 ▣ XTree Gold 2.5 ..... 99.

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3629 ▣ Design Your Own Home-Architecture 3.0 63
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1836 ▣ Where in America's Past is Carmen ... 39.
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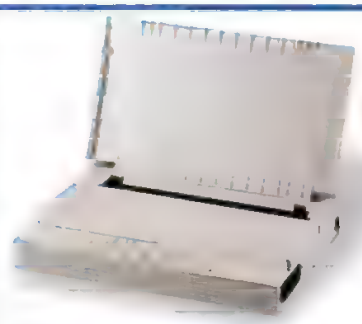
4388 ☐ SimAnt from Maxis . 39
4411 ▣ SimEarth for Windows from Maxis 45
Davidson & Assoc. ... NCP
3947 ▣ Math Blaster Plus ..... 29.
4183 ▣ KidWorks ..... 29.



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7894 *BJ-10ex Printer*–New enhanced version of the popular 4.6 lb. printer provides laser-like print quality (up to 360 dpi) on plain bond paper, envelopes or transparencies. Available in white or gray ..... $339.

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4534 ▣ Mavis Beacon Teaches Typing 2.0 *(CP)* 35.
3031 ▣ Mavis Beacon for Windows ..... 45.
3023 ▣ ChessMaster 3000 ..... 35.
Harvard Associates ... NCP
2324 ▣ PC Logo 3.0 ..... 59.
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☐ Word Torture for Windows ..... ea. 34.
☐ Word Torture 3.0 ..... ea. 29.
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3861 ☐ Knowledge Adventure 1.0 ..... 65.
Microsoft ... NCP
7881 ☐ Entertainment Pack for Windows 1.0 .. 29.
2858 ☐ Flight Simulator 4.0 ..... 39.
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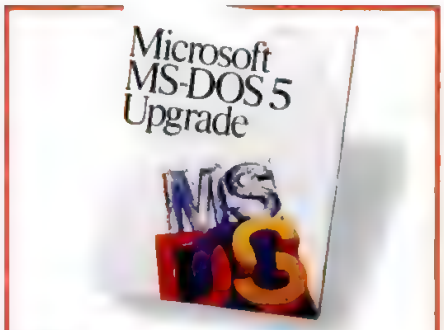
▣ VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese) ..... ea. 35.
Personal Training Systems ... NCP
Training tutorials - beg. to adv. for Windows, Excel, PageMaker, & Lotus 1-2-3 *(3½")* ea. 65.
Sierra ... CP
9466 ☐ Space Quest IV *(VGA)* ..... 45.
3193 ☐ Police Quest III *(VGA)* ..... 45.
Software Toolworks ... NCP
3294 ▣ Game Pak *(5 games in one)* . . 32.
5032 Miracle *(piano teacher) (incl. kybd.)* . 359.
Spectrum Holobyte ... NCP
4834 ▣ Super Tetris ..... 32.
4833 ▣ Super Tetris for Windows ..... 32.



Microsoft ... NCP
1620 ☐ *MS-DOS 5 Upgrade*–Improved graphical shell, on-line help, task swapping, full screen editor, & more are all awaiting you w/MS-DOS 5 Upgrade. Upgrade your current DOS with ease to MS-DOS 5 Upgrade for only ... $65.

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2704 ▣ Nemesis Deluxe Toolkit 5.0 for Windows 75
True BASIC, Inc. ... NCP
▣ Kemeny/Kurtz Math Series ..... ea. 45.
Walt Disney Computer Software ... CP
2629 ▣ Mickey's 123's ..... 35.
2624 ▣ Mickey's ABC's ..... 35.
4398 ▣ The Animation Studio ..... 79.

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7108 Smart UPS 400 ..... 339.
7105 Smart UPS 600 ..... 469.
3858 Back-UPS 400 ..... 185.
3823 Back-UPS 600 ..... 299.
ATI Technologies ... 2 years
9821 VGA Basic-16 *(640 x 480, 16 colors)* 69.
2706 VGA Wonder XL *(with 1 MB)* 199
2382 Graphics Vantage VGA *(with 1 MB)* 359.
9822 Ultra *(with 1 MB) (requires VGA)* ... 419.
2012 Graphics Ultra with VGA *(with 1 MB)* .... 479.
1825 2400etc/i Modem *(with 9600 SendFax)* . 139.
9620 9600etc/e Modem ..... 379.
3902 Stereo•F/X ..... 149.
3900 VGA Stereo•F/X *(w/512K, upgrd. to 1 MB)* 329.
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7150 BOCARAM/AT PLUS *(2 MB)* ..... 219.
7139 *(4 MB)* .... 329. 7138 *(8 MB)* .... 539.
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6999 I/O Board for Microchannel *(S/S/P)* ..... 109.
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7801 FlightStick with Falcon ..... 49.

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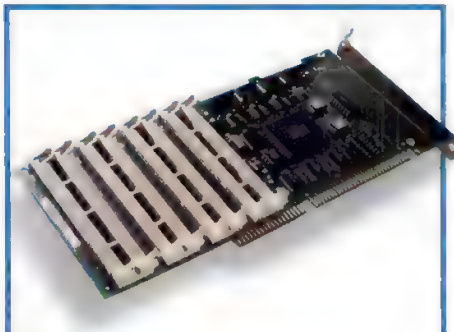

Intel ... 5 years
1086 *Matched Memory Classic Memory Board 2K*– Great performance with a great price to match. EMS 4.0 compatibility built in to the hardware for up to 90% faster processing. Expandable to 8 MB using 1 MB SIMMs ..... $139.

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Epson ... 2 years
We are an authorized Epson Service Center.
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1904 FX-1050 *(136 col., 264 cps, 9 pin)* ... 449.
2358 LQ-570 *(80 col., 252 cps)* ..... 289.
2361 LQ-870 *(80 col., 330 cps)* ..... 489.
2357 LQ-1170 *(136 col., 330 cps)* ..... 669.
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Everex ... 1 year
1683 Tempo LX Notebook *(5 MB, 60 MB HD)* call

Hauppauge Computer ... 1 year
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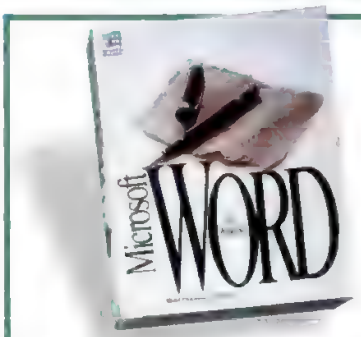
3020 T224FM 96/24 Pocket Fax Modem .... 249.
1187 T324FM 96/24 Fax Modem *(Toshiba Lptps.)* 269.



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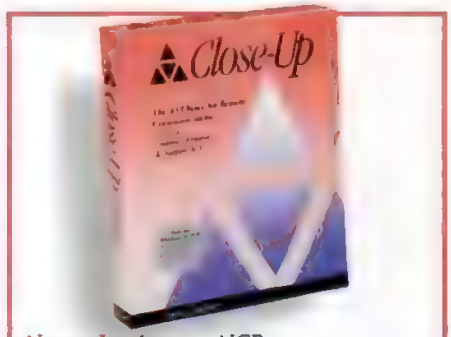
9833 Pacific Page XL *(w/accelerator board)* .. 779.



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6201 Isobar 8-12 *(8 outlets, Gold Seal Warranty)* 69.
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1603 DG60M 4mm Data Cartridge *(1.3 GB)* ... 16.
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1609 QG112M 8mm Data Cartridge *(5 GB)* .... 15.
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6715 QD6150 .... 23. 1602 QD6250 .... 29.

3M ... lifetime
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PC Confusion.

Don't know which way to turn?
(Or, the node not taken.)

We tend to take the road less travelled up here in the lovely, dark, and deep woods of Marlow, NH (pop. 568). We've introduced services like toll-free technical support, recycled packing materials, and One Minute Mail Order™ long before anyone else in PC mail order. And to our customers, that has made all the difference. Because they know we have many promises to keep and will, in fact, go miles before we sleep to clear up any confusion about any program or peripheral you buy from us.

You see, when we first started in 1982, the hardest decision anyone had to make was whether to get an extra serial or parallel port. But over the years technology has taken some bewildering twists and turns, with upgrade paths diverging all over hither and yon. And then some. So before you venture too far into unfamiliar territory, give us a call and we'll get you back on the straight and narrow.

Make a real impression.

Eliminate the confusion around your home or office with PC Connection rubber stamps including the universally recognized "Paws Up!" and "Paws Down!" symbols. We'll send them absolutely free, complete with stamp pad and ink, to anyone who places an order of $750 or more between now and March 31.

Prove you're a real yes-man. Or no-woman. Or vice versa...With a PC Connection Rubber Stamp Kit. One per customer.

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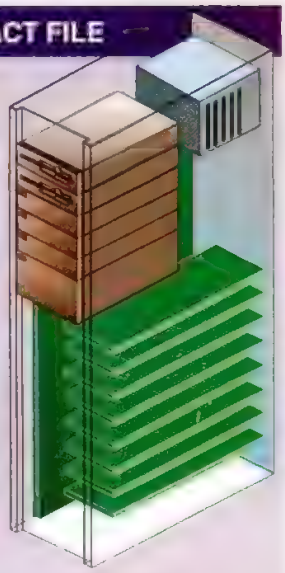


Tangent Model 433e Tangent Computer Inc., 197 Airport Blvd., Burlingame, CA 94010; 800-223-6677, 415-342-9388.
List price (tested configuration): $7,838.
Memory and processor RAM cache: 16MB 60-ns. SIMMs, 128K cache.
Disk drives and controller: Seagate 12-ms. 339MB SCSI hard disk, Mylex controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond Flower 720-by-350 monochrome adapter, Samsung 12-inch monitor.
Monitor refresh rate: 50 Hz.
Software: DOS 5.0.
In Short: The Tangent Model 433e did well on PC Magazine Labs' LAN benchmark tests for evaluation-station throughput and server utilization under the Hard Disk Access Load test. With its caching SCSI disk controller and space for five half-height and two full-height drives, the system is a good choice for a 20- to 30-user network.

CIRCLE 514 ON READER SERVICE CARD

top, so you can tip the unit and move it around. To open the case, the left side panel slides back and then hinges out; the hinges don't appear too sturdy. The drive bays can accommodate five half-height drives and one full-height drive. The case also has a hinged metal bracket running from front to back that can hold another full-height drive. To insert or remove the hard disks and floppy disk drives, you must first remove the front panel, which needs a good tug. All the drives snap into place. Tangent Computer Corp. also sells a stretch supertower with ten bays, a high-speed fan, and a cooling package.

The PC Magazine Labs staff encountered only one problem when setting up the system: an error message that said the system had exceeded the maximum suggested milliamperage capacity. We ran all the tests anyway, without any problems. This error is similar to the one we encountered with the Zeos 486-33E and is attributed to a software problem related to Mylex's EISA configuration software.

The Model 433e posted excellent scores on all server throughput tests. On the server utilization tests, its ratings compared favorably with those of the better-performing machines.

Tangent does not plan to obtain Novell certification. Although the Model 433e itself is not certified, its main component parts—motherboard, hard disk controller, disk drives, and Ethernet boards—are. A Tangent representative noted that each server must survive a rigorous Tangent certification procedure that includes 72 hours of testing. Tangent supports networks through its usual support lines: Monday to Friday from 8:00 to 6:00 P.S.T, and Saturday from 10:00 to 5:00. The company maintains a 24-hour BBS as well. It offers a one-year warranty on parts and labor (two years for the motherboard) and a 30-day money-back guarantee.

At $7,838, which includes two Ethernet adapters at $375 each, the Model 433e is one of the lower-priced systems reviewed here. Tangent sells a 100-user *NetWare* package for $5,100 with this system ($6,995 without) and charges $550 to install the software and certify the system for *NetWare* use. You can also buy a disk-arrayed Tangent server that has two non-caching host adapters, four Quantum 210 SCSI hard disks, and disk-array driver software.

The Tangent Model 433e has a good mix of features, performance, and price. If Novell certification is not a high priority for you, this is a server you may indeed want to own.

TRI-STAR COMPUTER CORP.

Tri-Star Flash Cache 486E

BY GREG PASTRICK It is hard to believe that you can get the Tri-Star Flash Cache 486E, a 33-MHz 486-based EISA packaged for server duty, for only $6,995.

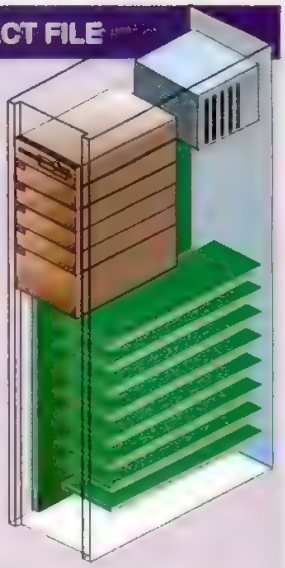
The Flash Cache unit we tested came with 8MB of RAM and 256K of 20-nanosecond static RAM cache. An UltraStor Ultra 22C caching ESDI controller, which has 4MB of RAM cache, controlled both the mirrored 14-millisecond 760MB Maxtor XT-8760E ESDI hard disks and the two TEAC floppy disk drives (1.2MB and 1.44MB).

The Flash Cache's Super VGA video subsystem consisted of a 1MB Diamond SpeedSTAR Super VGA card and a 14-inch MAG PMV1448 noninterlaced color monitor that displays 1,024-by-768 resolution at 60 Hz. Since Super VGA is wasted on a machine destined for server work, Tri-Star Computer Corp. offers plain monochrome VGA, dropping the already low price even further.

Installing *NetWare*, Version 3.11, was straightforward, although Tri-Star does not sell *NetWare* or offer *NetWare* support. The Free Technologies motherboard accepts a system total of 64MB page-mode RAM, made up of 80-nanosecond 4MB SIMMs. BIOS operations are managed by an Award EISA 486 chip. Setup information is stored both in CMOS setup and in the files created by the configuration utility. The BIOS setup menu lets you make only limited changes to the parameter settings, however.

Two of the motherboard's eight expansion slots are 16-bit ISA slots. In our test unit, these held the video and AD-450 multiple I/O card. Five of the remaining

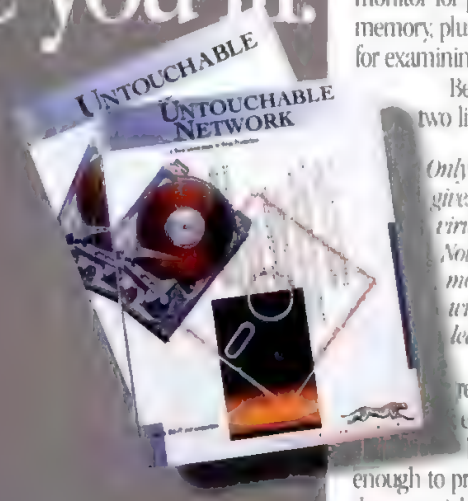
FACT FILE



Tri-Star Flash Cache 486E Tri-Star Computer Corp., 120 S. Weber Dr., Chandler, AZ 85226; 800-678-2799, 602-961-3401.
List price (tested configuration): $6,995.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Two Maxtor 14-ms. 760MB ESDI hard disks, UltraStor controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, MAG Computronic 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The Tri-Star Flash Cache 486E, set up to power a 32-node network for our review, offers abundant mass storage, ample system memory and caching, and performance adequate enough to handle the task. What is remarkable about the system is its rock-bottom price. Service and support are an enticement, but the system's internal design and construction are not.

CIRCLE 515 ON READER SERVICE CARD

Paying again and again for virus protection is enough to make you ill.



Frankly, paying anything at all is pretty nauseating.

But that's nothing compared to the feeling you get in your stomach when a drive full of data goes down the drain.

So you pay.

Then you pay again. For upgrades. Or quarterly "updates."

But even that doesn't buy you much peace of mind. Because each new day brings an average of six new viruses into the world.

Which means all anti-virus programs are inherently obsolete.

Except one.

Introducing Untouchable.™ The only software in the world that gives you 100% protection.

Today.

And tomorrow.

Like other anti-virus software, Untouchable is equipped with a TSR monitor for patroling your system memory, plus a scanner/remover for examining the files on your disk.

Between them, these first two lines of defense can recognize and obliterate hundreds of the little buggers — enough to protect you from 95% of the potential carnage.

Only Untouchable Network gives you centralized virus protection. Now you can install, monitor and control without having to leave your seat.

If you find that statistic reassuring, then you probably like the odds in Russian Roulette.

If you don't, you'll want to know that Untouchable is equipped with a unique *third* line of defense, which has been mathematically proven to be, well, untouchable.

Instead of looking for viruses, this third line of defense looks for *changes in your executable and system files.*

If the change is but a single byte, Untouchable will spot it and, using our patent-pending recovery technique, reconstruct the file to its original state.

The process is known as Generic Differential Detection, and certain other programs claim to perform it, too.

But only Untouchable calculates file signatures using not one, but two proprietary algorithms that can't be reverse-engineered.

Only Untouchable guarantees 100% safe recovery of infected files. (Unlike other programs that proudly generate corrupted files, Untouchable knows when the jig is up and doesn't attempt recovery.)

Only Untouchable can provide centralized network virus protection. In fact, Untouchable Network has enough virus alerts and reporting mechanisms to settle the stomach of even the most nervous Netware® administrator.

And only Untouchable is backed by our vaunted 24-hour toll-free technical support and a one-year money-back guarantee.

If you're worried about viruses — and you should be — don't reach for the Maalox.® Reach for the phone. Dial 1-800-677-1848.

You'll feel better right away.

FIFTH GENERATION SYSTEMS, INC

CIRCLE 288 ON READER SERVICE CARD

six EISA slots were filled by the UltraStor ESDI controller and the four Token-Ring cards we installed for our testing.

Though the Flash Cache's design allows ample room for loading the system with up to five half-height drives (two accessible from the front), deploying the space available inside the case is not as easy with full-height drives. Although one full-height drive fits easily into a rack mount, you have to attach the other to a swing mount, which positions it with little clearance over the SIMM sockets and above the column of expansion slots.

On PC Magazine Labs' LAN benchmark tests, the Flash Cache's server utilization scores were fine, but its Hard Disk Access Load scores showed throughput that was well below average.

Like others in the Tri-Star 486 series of towers, the Flash Cache has some noteworthy design points, like built-in wheels for rolling the tower to its permanent station. What it lacks, however, is the room to pack in big multiple drives. You can fit in only two high-capacity drives, although the optional large-format SCSI and ESDI hard disks, which range from 330MB to 1.2GB, can take care of most server needs.

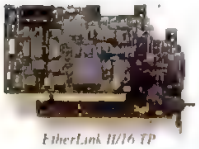
A big selling point for Tri-Star has always been the company's generous service-and-support policies.

A big selling point for Tri-Star has always been its generous service-and-support policies, starting with a 60-day money-back guarantee, a two-year warranty on parts and labor, and free on-site service from NCR during the first year. Toll-free technical support and a 24-hour BBS are there to bail you out if you need it. Even so, Tri-Star's biggest selling point is the pricing for its line of 386 and 486 systems.

To get these qualities in a 16-bit ada

Wouldn't it be nice if you could slow your spending down while speeding your network up?

That's the spirit behind the new EtherLink II/16 adapters. You'll find them a smart, frugal way to put 16-bit power onto your network.


EtherLink II/16 TP and EtherLink II/16 coaxial

The EtherLink II/16 family uses the same software drivers as the popular EtherLink II adapter, and they're based on the same proven technology. So you'll find installation easy. No fiddling with new software. No complicated adjustments to your network. Just plug in the EtherLink II/16 TP for twisted-pair or the EtherLink II/16 for coaxial, and you're up and running.

And if you are not among the 1.6 million people who already use EtherLink II, rest assured. Putting the new EtherLink II/16 family on your network for the first time

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You can find other well-constructed and finely designed server towers, but for what you get with the Tri-Star Flash Cache 486E, you will be hard-pressed to find a more inexpensive server tower.

WANG LABORATORIES INC.

Wang EC 480/33C

BY PATRICK HONAN If you want soup-to-nuts service when buying a server, the Wang EC 480/33C may be ideal. Wang Laboratories will install and configure your network operating system before shipping you the machine. Inside the sturdy chassis are quality components that should provide problem-free service. Finally, Wang has service options that range from basic hardware phone support to in-depth LAN software support and remote diagnostics.

The hitch is that such service does not come cheap. The review unit had a suggested list price of $17,955 for 16MB of RAM, a 128K RAM cache, a 632MB hard disk, an EISA SCSI controller with 4.5MB RAM cache, a 150MB tape drive, a 1.2MB floppy disk drive, and a Super VGA monitor and board. Wang Laboratories may negotiate discounts depending on quantity and configuration, however. Options include EISA Ethernet and Proteon Token-Ring cards at $1,045 and $1,245, respectively.

Wang does not sell a tower case, so it packs the EC 480/33C into a desktop model that measures 6.5 by 21.5 by 16.5 inches.

Inside are five half-height drive bays, three of which are accessible. You can therefore install a full-height 1.2GB hard disk, the largest that Wang sells, and still have enough room for three removable drives. While this arrangement may be sufficient storage for some, others will find that it does not afford much freedom, either for configuring the system now or for the way the network may later evolve.

Wang sells add-on boxes, measuring approximately 6 by 12 by 12 inches, that have their own power supply and hold two half-height bays that you can daisy-chain to a SCSI port on the back of the SCSI hard disk controller. Wang requires you to buy

pter, you'll have to spend a bit less.

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takes less than five minutes. No other 16-bit adapters are compatible with more types of software than EtherLink II/16 TP or EtherLink II/16 coaxial. You can run them on NetWare, LAN Manager, Banyan VINES, UNIX and DEC Pathworks to name just a few. And they come with network management capabilities.

What's more, the EtherLink II/16 family is so reliable they're backed by a limited lifetime warranty.

But why not see for yourself? Call **1-800-NET-3Com** for more information. Or visit your 3Com reseller. And see how you can get more by spending a little bit less.

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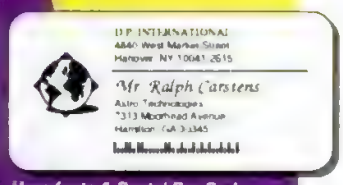

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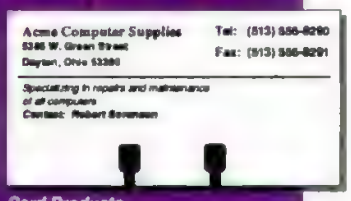

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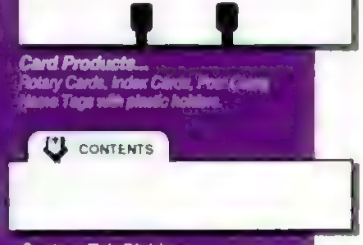

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them with at least one device installed. A box with a full-height 632MB SCSI hard disk costs $7,895. These add-ons solve the storage problem but elevate the system cost and take up more space than a tower case would.

The EC 480/33C's EISA SCSI controller, made by Distributed Processing Technology (DPT), is available with RAM caches ranging from 512K to 4.5MB. In early 1992, Wang expects to offer a new version of the controller that will support a 16.5MB cache. The Hewlett-Packard SCSI hard disk had a rated access time of 16.5 milliseconds. The system accepts up to 64MB of 80-nanosecond RAM, all added to eight SIMM sockets on the motherboard.

The EC 480/33C may have a modest case, but the components inside pumped out solid power on PC Magazine Labs' LAN benchmark tests. PC Labs had no trouble configuring the system, which did well on the Hard Disk Access Load test, and to its credit showed a lower-than-average server utilization score.

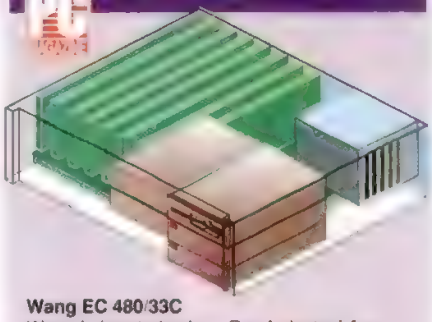
The Wang EC 480/33C may have a modest case, but the components inside pumped out solid power on PC Labs' benchmark tests.

What else do you get for your money? For starters, the EC 486/33C is certified by both Novell and Banyan. Then there is Wang's network-specific technical support, which you can purchase at one of three levels. If the reviewed system were configured for 100 users, the first level, which offers telephone support to the LAN administrator and help with the network operating system and applications, would cost $270 per month. The second level, which adds remote diagnostics and monitoring to the first level, would cost $419 a month. The third level, which adds client-based telephone support to the first two levels, would cost $1,120 per month. These aren't cheap, but they show Wang's commitment to this segment of the PC market.

Wang backs the machine with a one-year parts-and-labor warranty and offers on-site service for $42 per month to cover problems with components and hardware apart from the network.

The Wang EC 480/33C's price simply will not fit into some budgets. But if you think the support options Wang offers and the Novell and Banyan certification can make a difference in how efficiently your employees work on the network, then give the Wang EC 480/33C a long, hard look.

FACT FILE



Wang EC 480/33C
Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; 800-835-9264, 508-459-5000.
List price (tested configuration): $17,955.
Memory and processor RAM cache: 16MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Hewlett-Packard 16.5-ms. 632MB SCSI hard disk, DPT controller with 4.5MB cache, 1.2MB floppy disk drive.
Display: Wang 1,024-by-768 adapter with 512K RAM, Wang 14-inch monitor
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.
In Short: The Wang EC 480/33C is one of the more expensive systems to choose from, but it is a solid value when you consider its performance and the quality and network-specific support Wang Laboratories provides. The machine finished in the top half on PC Magazine Labs' LAN benchmark tests. The EC 480/33C comes in a desktop case, and users who want to add a variety of storage devices may find the five available bays, three of which are accessible, a bit limiting

CIRCLE 516 ON READER SERVICE CARD

ZEOS INTERNATIONAL LTD.

Zeos 486-33E

BY JOSEPH DESPOSITO A good blend of network components, performance, and service, along with pending Novell certification, make the Zeos 486-33E a good server for you to consider.

For this review, Zeos International con-

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CIRCLE 304 ON READER SERVICE CARD

figured its $9,740 server with 16MB of RAM, a 128K RAM cache, two duplexed 330MB Seagate ST4376N hard disks rated at 17 milliseconds, two Mylex DCE 376 bus-mastering SCSI caching controllers with 8MB of RAM each, a multiscanning monitor manufactured for Zeos by CTX International, a 1MB Diamond SpeedSTAR Super VGA board from Diamond Computer Systems, and an I/O board.

Zeos does not sell disk arrays. The tower case, which does not have wheels, rests on a platform. Front-accessible drive bays can accommodate four half-height 5.25-inch drives. Inside, there is room for two more half-height 5.25-inch drives and two half-height 3.5-inch drives. To get inside, you must remove the whole cover. Since the front panel is not easy to remove, you can insert or remove hard disks in the two top internal bays only by removing the power supply first.

Both the CTX monitor and the 1MB Diamond SpeedSTAR Super VGA board can display 1,024-by-768 noninterlaced resolution at 70 Hz. The system is powered by a 450-watt Turbo-Cool power supply from PC Power and Cooling.

None of the eight EISA expansion slots on the Zeos 486-33E were left open after we added four Token-Ring Network Interface Cards to the system.

The Zeos 486-33E had a Mylex MAE series EISA motherboard, whose 16MB of 80-nanosecond RAM is expandable to 32MB; many systems in this roundup could support 64MB. None of the eight EISA expansion slots on the motherboard were left open after we added four Token-Ring NICs to the system.

We encountered only one problem dur-

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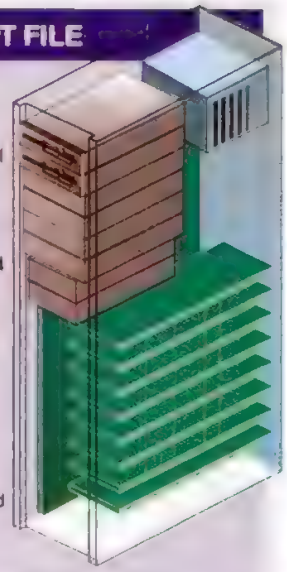

Zeos 486-33E
Zeos International Ltd., 530 Fifth Ave. NW, St. Paul, MN 55112; 800-423-5891.
List price (tested configuration): $9,740.
Memory and RAM cache: 16MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Two Seagate 17-ms. 330MB SCSI hard disks, two Mylex controllers with 16MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Zeos 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0; Windows 3.0; *Ami Pro*, Version 2.0; *Lotus 1-2-3 for Windows*.
In Short: The Zeos 486-33E rates an "A" in performance. With mirrored drives, caching SCSI controllers, and eight drive bays, this server is a good choice for a small to medium-size network.

CIRCLE 517 ON READER SERVICE CARD

ing setup: an error message reporting that the system had exceeded maximum suggested milliamperage capacity. We ran all tests anyway, and everything worked fine. This error report, similar to the one encountered by the Tangent Model 433e, is attributed to a software problem related to Mylex's EISA configuration software.

On PC Magazine Labs' LAN benchmark tests, the Zeos 486-33E server posted better-than-average scores on both the Hard Disk Access Load and the server utilization tests.

Although the Zeos 486-33E itself is not certified, its motherboard is. At the time of this writing, Zeos was in the process of gaining Novell certification for the system. Zeos fields network problems through its usual technical support lines 24 hours a day, 365 days a year. The company offers a one-year warranty on parts and labor (five years for the keyboard), as well as a 30-day money-back guarantee. On-site service from TRW is available for $49 for the first year.

The price of the system, $9,740, includes a software bundle of *Lotus 1-2-3 for Windows*, *Lotus Ami Pro*, and Microsoft Windows 3.0, and also comes with a Microsoft Mouse. This bundle does little to help a server, however. Zeos does not sell *NetWare*.

The Zeos 486-33E offers fine performance and has a reasonable price for a configuration that includes duplexed hard disks.

The Zeos 486-33E offers fine performance and has a reasonable price for a configuration that includes duplexed hard disks. If you don't need Novell certification right now and don't mind purchasing *NetWare* from a different source, you may want to consider this system. ■

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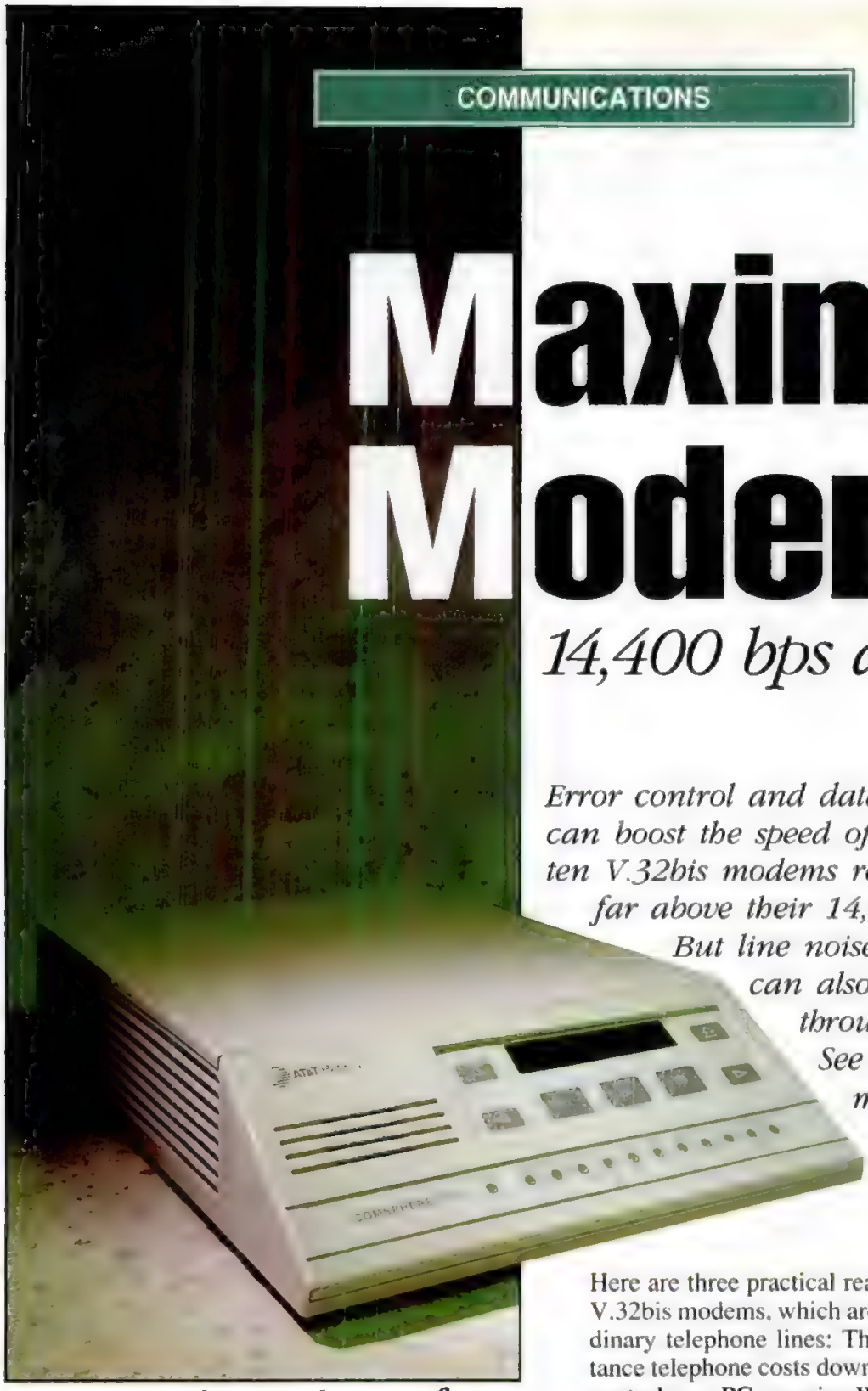
Error control and data compression can boost the speed of the ten V.32bis modems reviewed here far above their 14,400-bps rating. But line noise and distortion can also reduce throughput. See which models make it through.



PHOTOGRAPH: MARC DAVID COHEN

by Frank J. Derfler, Jr.

Here are three practical reasons to buy one of the new V.32bis modems, which are the fastest available for ordinary telephone lines: They can keep your long-distance telephone costs down, they provide faster remote control over PCs running Windows, and they can make you more efficient by delivering information faster. Of course, the desire to have the fastest modem on the block may also sway you. But as with touring sedans with 130 mph speedometers, you cannot always use the fastest modems at their highest speeds in real situations.

This review looks at the new V.32bis modems that offer signaling at 14,400 bits per second. Compared with the 9,600-bps V.32 modems we reviewed more than a

year ago ("9,600-bps Modems: Breaking the Speed Barrier," December 11, 1990), the latest models allow a potential 50 percent increase in throughput when moving a file.

Due to the relative immaturity of V.32bis technology, however, our experience suggests at this time that you select a V.32bis model over a lower-priced V.32 unit only if two conditions are true: if you have consistent high-quality telephone lines and if you will make calls solely between modems of the same brand. In the absence of high-quality telephone circuits, V.32bis modems often will not connect at 14,400 bps. And significant problems remain with mixed-brand compatibility at all speeds.

In this review we evaluate 10 modems: the AT&T Comsphere 3810, CXR AJ 9632-MM2, Digicom 9624LE Plus, GVC SM144V, Hayes V-series Ultra Smartmodem 14400, Intel 14.4 EX, Microcom QX/4232bis, MiCC 14410/SA, Codex 3260 V.32bis, and Courier V.32bis.

AT&T Paradyne's Comsphere carries a big price tag at $1,595, but it invariably offers performance to match the price. The modems from Digicom Systems, GVC Technologies, and Intel huddle together at just under $700; the rest group loosely around the $1,000 point. All are external models.

WELCOME TO THE EVOLUTION

The evolution of modems has occurred in regular and predictable stages. On the average, technological advances have doubled modem signaling speed every 18 months. While the industry does not deliver a new species of modem this often, the time between the appearance of new modem products and the improved speed of the newest products is closely correlated.

Aside from the market pull of the PC industry, the evolutionary process for telecommunications required action from the Federal Communications Commission even before the IBM PC showed up. This action allowed the attachment of non-Bell System equipment to telephone lines in order to spur competition. In 1984, affordable modems appeared that followed the International Telegraph and Telephone Consultative Committee (CCITT from the French abbreviation) V.22bis standard for 2,400-bps signaling. And in 1987, vendors such as Hayes Microcomputer Products and U.S. Robotics offered under-$1,000 modems with a 9,600-bps proprietary signaling scheme and data compression. In the same time frame, Hayes offered a modem with full-duplex CCITT V.32 9,600-bps signaling in the $2,000 price range. V.32 compatibility, in other words, did not come cheap.

In 1990, several modem vendors began to offer affordable modems with V.32 signaling and a new compression and error-control scheme called V.42bis. The V.42bis compression scheme offers an average 150 percent increase in throughput, depending on the compressibility of the data going through the modem. So

HIGHLIGHTS: V.32bis/V.42bis Modems

V.32bis modems use an internationally recognized scheme for transmitting computer data simultaneously in both directions over the regular dial telephone system at a rate of up to 14,400 bits per second. The modems do this by taking 6 bits and packing them into tone bursts, and sending 2,400 of these tone bursts in each direction each second.

CCITT Recommendation V.32bis ("bis" is French for "second") builds upon the V.32 Recommendation for 9,600-bps modems by defining transmission at 12,000 and 14,400 bps. Coupled with V.32bis is the ability for the modems to adjust the data transfer speed both up and down as the connection quality changes.

V.42 error control, available for quite some time in 2,400- and 9,600-bps modems, lets the modems help compensate for noise and other electronic "garbage" introduced by the telephone connection itself. (V.42 error control does nothing for the noise and garbage introduced into the data side of each modem.)

V.42bis adds a patented compression scheme to improve data throughput further, particularly on highly structured data such as text, spreadsheets, and databases. It is based on the Ziv-Lempel single-pass dictionary method, which recognizes repeated strings of data and transmits repeated strings as a single code. With a suitable choice of dictionary capacity and string length, the V.42bis compression algorithm achieves better than a 2:1 compression ratio on text, and even better compression ratios (as much as 4:1) on more structured files such as certain databases, spreadsheets, and graphic files.

V.32bis modems use *echo cancellation* to send tone bursts in both directions without interference. This means that the modems must test the channel to identify all the possible echo paths before using it. In August, the Electronics Industries Association/Telecommunications Industries Association finalized a new set of tests to thoroughly check echo-canceling modems. In this article, we use these newly defined tests.

The best-performing modem on our tests (AT&T Paradyne) was also the most expensive. The expense was due less to the cost of providing basic functionality than to the care taken by the vendor in testing the product and the vendor's ability to upgrade the modem's firmware automatically. As all the vendors make adjustments to their products, expect that V.32bis modems in the $750 retail neighborhood will work just fine.

Today's V.32bis modems are best suited to point-to-point applications between stations located within a company—or between two specific companies—over short distances, such as LAN bridging, interbuilding electronic mail exchange, on-demand file interchange, and telecommuting with remote-control software. These can be used with on-line services, BBSs, and private message systems that use V.32 modems as well. ■

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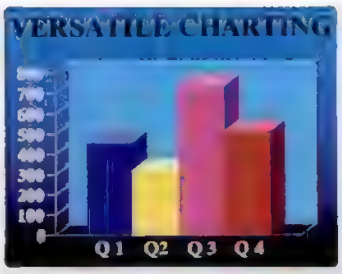

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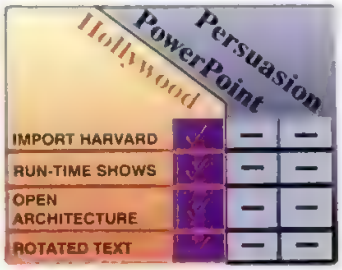

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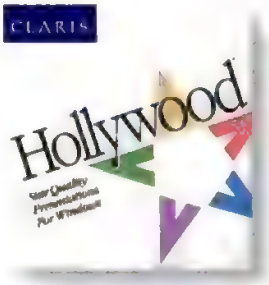

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while these modems still signal at 9,600 bps over the phone line, they can theoretically move data at speeds as high as 38,400 bps under ideal conditions. In practice, throughput of 20,000 to 25,000 bps is common when two modems use V.32-style 9,600-bps signaling and V.42bis compression to move compressible data such as spreadsheet files and some graphics files.

EDITORS' CHOICE

- **AT&T Comsphere 3810**
- **Intel 14.4 EX**

When we considered our Editors' Choice, we quickly chose a winner and a short list of good alternatives. Since the winner, AT&T Paradyne's $1,595 AT&T Comsphere 3810, might cost more and do more than suits you, being able to choose from among the rest is important. The products on our list of favorites are the Intel 14.4 EX, the GVC SM144V, the Codex 3260 V.32bis, the Hayes V-series Ultra Smartmodem 14400, and the U.S. Robotics Courier V.32bis.

AT&T's modem stands out for its compatibility, performance, reliability, upgradability, and ingenuity—and its high price. The company did everything right in the design and implementation of this product. The Comsphere worked for us every time over every line and with every other modem. If you have LAN-to-LAN, public information service, or other "bet-the-business" communications applications, this is the modem to buy.

In the lower-priced tier, the $659 GVC SM144V and the $699 Intel 14.4 EX both gave excellent performances. But the Intel modem is the only other product aside from the Comsphere 3810 that allows for a 57,600-bps connection. Intel is giving a great deal of attention to its personal computer products; you can expect good support for this modem from the company, the retail channels, and the developers of communications programs. The Intel unit is our second editors' choice for those who are not betting the business, but who want to move data quickly with the latest technology at a reasonable price.

Among honorable mentions, Motorola's $1,195 Codex 3260 V.32bis demonstrates excellent workmanship, and the Codex is the standard modem in several countries for good reason. We selected it as a *PC Magazine* "Best Of 1991" in the January 14, 1992 issue. The Codex is flexible, sets up easily, includes important management features, and offers industrial-grade reliability. At $1,195, it costs less than AT&T's product, but not a lot less. And the serial port will not go to 57,600 bps, so you can't squeeze the last drops of throughput out of the phone line.

Hayes Microcomputer Products' $1,199 V-series Ultra Smartmodem 14400, another excellent performer from a well-known company, is at the same price point as the Codex but has fewer features. Because of its internal X.25 capabilities, the Ultra 144 is also a smart choice for anyone with a direct line to a public or private X.25 network.

U.S. Robotics' $995 Courier V.32bis is also a good choice and sells for less. But while it is a safe and sound buy, the Courier is not compelling unless you already have U.S. Robotics products and want to maintain compatibility.

Before you buy, remember that V.32bis technology is still maturing. You will be most successful making connections between modems when they are the same brand (and then only over better-quality telephone lines). Because compatibility problems are not yet licked, you should expect the manufacturer to provide minimal-cost ROM upgrades for the next year. Or, if you must buy now, consider falling back to the earlier generation of slightly slower V.32 modems (9,600-bps signaling versus the 14,400 bps of V.32bis) that are several hundred dollars cheaper and somewhat better on cross-brand compatibility.

The V.42bis data compression scheme represents the state of the art among single-pass adaptive compression techniques. If you want to minimize the time and money you spend on telephone calls, it is always better to compress files before transmission using a multi-pass program such as ARC, LHARC, or PKZIP than it is to rely solely on V.42bis compression. These programs examine the contents of a file and use the best compression technique. But V.42bis provides good throughput when no pre-transmission compression technique is available. Unlike the older MNP 5 compression system still used by many modems, V.42bis compression will not slow down the transmission of already compressed files.

In late 1991, modem companies started delivering products that conformed to a revised signaling standard called V.32bis. Modems following this standard offer faster signaling than V.32 models and smoother fallback to a greater choice of speeds. V.32 modems try to connect at 9,600 bps; if they experience errors, they drop back in steps to speeds as low as 4,800 bps. The newer V.32bis modems more-extensively analyze the connection to determine immediately the best usable signaling speed—choosing from among 14,400, 12,000, 9,600, 7,200, or 4,800 bits per second. The specification also provides for a way that modems can agree to *fall forward* (speed up to a maximum 14,400 bps) if the line conditions improve.

All the modems in our review combine V.32bis signaling with V.42bis error-control and compression. In theory, this combination should provide throughput as good as 57,600 bits per second. As with so many top-end speeds, however, our testing shows that you only approach the theoretical maximum under ideal conditions on a closed track and with a professional driver. As we will describe later, both the telephone lines and the PC hardware itself work against optimal performance.

The V.32bis modems reviewed do not represent the final stage in modem development, but the end of the species is near. The CCITT is developing a standard, informally called V.fast, that should be approved in the spring of 1993; modems meeting this standard will provide signaling at 19,200 bps. But the highest speeds will be effective only under very specific conditions.

The evolving V.fast standard pushes

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against a principle of physics called Shannon's Limit. In simple terms, this law states that the maximum signaling speed is governed by the bandwidth and the ratio of signal to noise on the line. Since the bandwidth of dialed-up telephone lines is determined by technical standards and the modem output signal level is regulated by law, line noise effectively governs throughput. V.fast modems will be able to signal as quickly as ideal lines theoretically allow.

Digital signal processors, actually specialized computers for analog applications, are the evolutionary development that delivers V.32bis and V.fast modem speed. These devices are the operational heart of modern modems, including the ones reviewed. They allow easy upgrades through ROM swaps; this upgrade would otherwise require replacement of the modem itself. It is unlikely, however, that you will be able to upgrade a V.32bis modem to V.fast just by changing a ROM chip. Too many expensive elements must be over-engineered in the lower-speed modems to allow for such an easy upgrade.

In reality, V.fast may never result in a commercial product. Techniques such as Switched 56 service and ISDN (Integrated Services Digital Network) will more likely close V.fast's niche before any products make it to market. (See the sidebar, "All-Digital Service: Promise or Pipe Dream?") V.32bis modems could well be the last modems you will ever have to buy, because they will be the last generation of modems you can buy.

ROM DU JOUR

Because these products use programmable digital signal processors, they are what the code programmed into their ROMs tells them to be. As we prepared these reviews, we came to appreciate the work

ALL-DIGITAL SERVICE: Promise or Pipe Dream?

by Frank J. Derfler, Jr.

The V.32bis modems in this review and the so-called V.fast modem standard expected to follow in early 1993 are the last of a breed. Like glaciers from the north, fully digital telephone service is on the way to your home and to your office—approaching so slowly that you cannot see it happen over a week or a month, yet surely and inevitably.

Modems take the digital signals from your PC's serial port and convert them to audio tones that can travel over the old wiring running between your office or home and the telephone company's central office (CO) in your neighborhood. Curiously, at most COs the analog signals are converted to digital pulses, which complete the trip across the country or under oceans. Only when the signals hit the CO at the destination end does switch equipment convert the digital pulses back to the audio tones that are received by the other modem.

The Integrated Service Digital Network (ISDN) is an international plan to install totally digital end-to-end telephone service. Once implemented, it should offer better reliability and throughput using digital channels that can handle much higher speeds than voice-grade circuits. Users will be able to connect computers, fax machines, telephones, and other communications devices to any other device that supports ISDN. Voice, data, and video will be able to economically and simultaneously travel over the same digital ISDN lines.

Despite the promise of ISDN, however, many factors have understandably slowed the move to all-digital service in the United States. The primary obstacles are regulation and long depreciation schedules for the switch equipment used in COs, along with the technical problems inherent in linking switching centers. Other technical challenges remain persistent, such as the need to provide power to digital telephones especially during emergencies and blackouts.

The very high prices predicted for PC ISDN adapters (needed to establish connections) have served to douse the spark that could have ignited a bonfire of demand for ISDN service. The last painful step is telling people they must throw away their old analog phones and buy a much more expensive digital phone to use on a more expensive digital line that may not allow extension instruments. This part will need to be done very slowly.

Buildings and organizations that use gateways to ISDN service, such as a digital PBX system, will make the first real inroads to ISDN. AT&T Network Systems, in fact, has developed a prototype device called a home network controller that ties existing analog telephones and similar devices into the ISDN service lines. But the real burden on ISDN will come from connecting millions of PCs through reasonably priced internal adapters.

CURRENT ALTERNATIVES

While we wait for ISDN to infiltrate homes and offices and deliver 64 kilobit-per-second digital service to each desktop, other techniques are making a frontal attack on delivering all-digital service. If you use only modems to make repeated calls to the same locations in your organization, you should seriously consider a service called Switched 56.

When you order Switched 56 services from the local telephone company, you get a completely digital circuit between the CO and your facility. Amazingly, Switched 56 monthly service charges are often exactly the same as those for a regular voice telephone line.

While you must also buy or lease the termination equipment that links your PC or LAN communications server to the Switched 56 circuit, these devices typically cost less than the V.32bis modems in this review.

A Switched 56 circuit gives you the ability to call or to receive calls at 56 Kbps from any other Switched 56 subscriber without the roulette roll of modem compatibility or the certain signal degradation found in local analog circuits. However, the same problems of moving data at high throughput into an RS-232 port exist in the PC regardless of whether you use a modem or Switched 56 service. So, if you want maximum throughput, consider equipping one networked PC with a device such as the $1,345 EiconCard

involved in writing this code, for each company had the opportunity to upgrade its ROMs at various stages of the testing. Several large and small companies did.

Our experience has important implications for anyone buying these modems. First, shop with an eye on the nameplate as well as the price and performance figures. You should choose a product from a company that will be in the business long enough to refine its ROM programming as needed, although a good track record does not necessarily guarantee a good future. Second, do not expect to get ROM upgrades automatically from any company except AT&T. The Comsphere has flash memory that can take updates through a modem-to-modem telephone call to the AT&T support center. All the other companies are required by FCC regulations to have a service technician replace chips, typically at a maintenance facility.

It is true that most ROM updates make small changes that have an impact on only a few users. One example includes a ROM change created so that a modem can recognize the busy signal or dial tone generated by a specific brand of PBX. Other changes, however, have a more generalized impact.

Our advice is clear: First, check on the company's upgrade policy before you buy. Second, if you have a problem with one of these modems, contact your dealer or the vendor itself to see if the latter knows of the problem and has made ROM changes to solve it. The ROM tells the modem how to do its work, so do not be slow to ask for new instructions if you think you need them.

HSI adapter and sharing its services as a communications server.

Among its functions, the EiconCard gives the PC a buffered V.35 serial port connection to Switched 56 interface equipment. Purists might argue that the typical character-oriented PC applications using interrupt 14h do not take maximum advantage of this equipment, but these applications work today without modification or development.

The idea of running fiber-optic cable to the curb outside every building and offering digital services in the megabit range continues to interest many people. But despite field trials and programs dating back to the mid-1980s, the economics do not work. The least expensive curbside fiber-optic installations still cost twice as much as copper wire.

Even some initiatives to use cable television circuits as a means of moving two-way data within a community show more light than do plans for telephone company fiber-optic.

Today's services such as Switched 56 offer attractive alternatives to analog modems in some applications. By 1995, ISDN services are expected to be available in most of the US, and ISDN should be heavily utilized in Japan and parts of Europe. In the meantime, the latest V.32bis analog modems make the most of low-cost dial-up telephone lines and provide a reasonable way to link LANs and connect individual PCs. ■

REVIEW CRITERIA

The modems included in this review had to satisfy several criteria. First, they had to be external, which many users prefer at high speeds for the luxury of status lights. Second, they had to offer V.42 and V.42bis compatibility in addition to V.32bis. They also had to offer both asynchronous and synchronous operation and they had to have dial-up capability.

All the products we reviewed fulfilled every criteria, but we were unable to review every V.32bis modem that you may now find on the market. The timing of our story caught Multi-Tech Systems, a company that fielded two previous Editors' Choice modem products, in the middle of a major product revision. (This vendor expects to be in the V.32bis market in early 1992.)

Also not ready in time for this review was a portable modem from Microcom, the MicroPorte 1032bis. The $849 modem measures a miniscule 1.4 by 3.8 by 4.5 inches (HWD), includes robust MNP 10 adverse channel enhancement, and comes bundled with Microcom's *Carbon Copy Plus* modem remote-control software.

Another product not included, the $2,299 Shiva NetModem/E, allows *NetWare* users to dial in and dial out and also to link LANs. Using an Ethernet connector rather than the RS-232 port required for this roundup, the NetModem/E acts as a network node and includes V.32bis modulation and V.42bis data compression for transmission up to 57,600 bps.

Shop with an eye on the name, but a good track record may not guarantee a good future.

In addition, two companies pulled their V.32bis products from the roundup during our testing cycle. Prometheus Products withdrew its product from the market and recalled existing products from the shelves; Memotec returned its product to the drawing board pending more exhaustive testing.

Among other companies not represented in this review, nine more vendors did not have their V.32bis modems ready to ship in time for testing: ATI Technologies, Best Data Products, CompuCom Corp., Data Race, General Datacomm, Image Communications, NEC America, Practical Peripherals, and UDS. Six modem vendors—Cardinal Technologies, DataTrek Corp., Everex Systems, FastComm, Supra Corp., and Western DataComm—did not have V.32bis modems at

OUR CONTRIBUTORS

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M. Keith Thompson is a frequent contributor to *PC Magazine*.

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Max. Memory	16 MB	3 MB	6 MB	16 MB
CPU Cache	none	none	none	none
Hard Drive	40 MB IDE	20 MB IDE	30 MB IDE	60 MB IDE
I/O Ports	2 serial 1 parallel monitor keyboard	1 serial 1 parallel monitor	1 serial 1 parallel monitor keyboard	2 serial 1 parallel monitor keyboard
Screen	9" 32 grey	10" 32 grey	10" 32 grey	9" 32 grey
Software	MS-DOS 5.0	none	MS-DOS 4.01	MS-DOS 5.0
Weight	6.5 lbs	7 lbs	6 lbs	6.5 lbs
Price	$1299	$1495	$1995	$1599

	ZEOS 386SX-20	Nortngate 386SX 20	Compudyne NBSL/20	Zenith Mastersport 386SL
CPU	Intel386SX 20 MHz	Intel386SX 20 MHz	Intel386SL 20 MHz	Intel386SL 20 MHz
Std. Memory	1 MB	1 MB	2 MB	2 MB
Max. Memory	5 MB	5 MB	6 MB	8 MB
CPU Cache	none	none	64 K	64 K
Hard Drive	20 MB IDE	40 MB IDE	60 MB IDE	60 MB IDE
I/O Ports	1 serial 1 parallel monitor	2 serial 1 parallel monitor keyboard	2 serial 1 parallel monitor keyboard	1 serial 1 parallel monitor keyboard
Screen	10" 32 grey	8.5" 32 grey	10" 64 grey	9" 32 grey
Software	none	MS-DOS 5.0	MS-DOS 5.0	MS-DOS 4.01
Weight	7 lbs	6.1 lbs	6.4 lbs	6.8 lbs
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CIRCLE 132 ON READER SERVICE CARD

all, although by now products may well be available. Forval America, IBM, and Racal-Datacom offered only internal modems; the units sold by Gandalf Data and Racal-Milgo (in addition to the internal Racal-Datacom product) were leased-line only. Telebit declined to participate in the review, and two companies, Octocom Systems and Penril-Datacom, did not contact us in time for testing.

During our testing, we encountered a problem that is an old one in the modem industry: incompatibility. The challenges to vendors become more difficult as modems become more sophisticated and the number of models and vendors grows. While most companies cooperate to solve the problems by adjusting a timing loop here and a compensation factor there, our tests clearly showed that the companies have not had time to work out all the problems among these modems.

We spent dozens of hours on the test bench and on long-distance lines trying to determine which modems worked to-

MEETING OF MINDS: Modems and the PC's UART

by Winn L. Rosch

Modems and computers don't think the same. While your PC pores over problems in parallel—8, 16, or 32 bits at a time—your modem wants to look at data in a single bit-wide stream. Bringing together these two divergent modes of thought requires a conversion process; in nearly every serial port (included those embedded as part of internal modems) this is carried out by a Universal Asynchronous Receiver/Transmitter chip, or UART.

The design of the UART chip determines the speed and compatibility of the serial port or internal modem using it. Three very specific integrated circuits have served as UARTs throughout the history of IBM-standard personal computers: the 8250, 16450, and 16550 chips.

The first of these was the 8250. This 8-bit chip was the basis of the Asynchronous Communications Adapter (a fancy name for "serial port") in IBM's original Personal Computer. Because programmers took direct control of this chip when they wrote communications software, all later serial ports have had to duplicate the 8250's functions in order to remain compatible.

The problem of the 8250 is that it is slow and cannot keep up with even the modest bus speed of AT-class computers. Consequently, in 1984 hardware designers turned to the 16-bit register-compatible successor of the 8250: the 16450 UART. Since that time, this chip has continued as the mainstay of most serial ports. And because expansion bus speeds have not changed substantially in the last 8 years, the 16450 rates as fast enough for most uses.

A development other than speed, however, has proven to be a challenge to the 16450—multitasking. When one of these older UARTs receives a word of data across the communication line, it has to do something with that information before it can accept another word. In most communications systems, the UART signals its microprocessor host with an interrupt, then delivers the data word to the microprocessor and goes back to telecommunicating. In sending data, the chip similarly accepts only one word at a time.

This process has severe drawbacks, particularly because the microprocessor may be busy with another task at the moment that the UART is attempting an interrupt. Once signaled in this fashion, the processor must drop whatever it is doing to service the UART. But since the UART and communication line may first have to wait, performance suffers on both ends of the UART. Exacerbating the situation are the data needs of high-speed modems such as the V.32bis models reviewed.

A NEAT SOLUTION

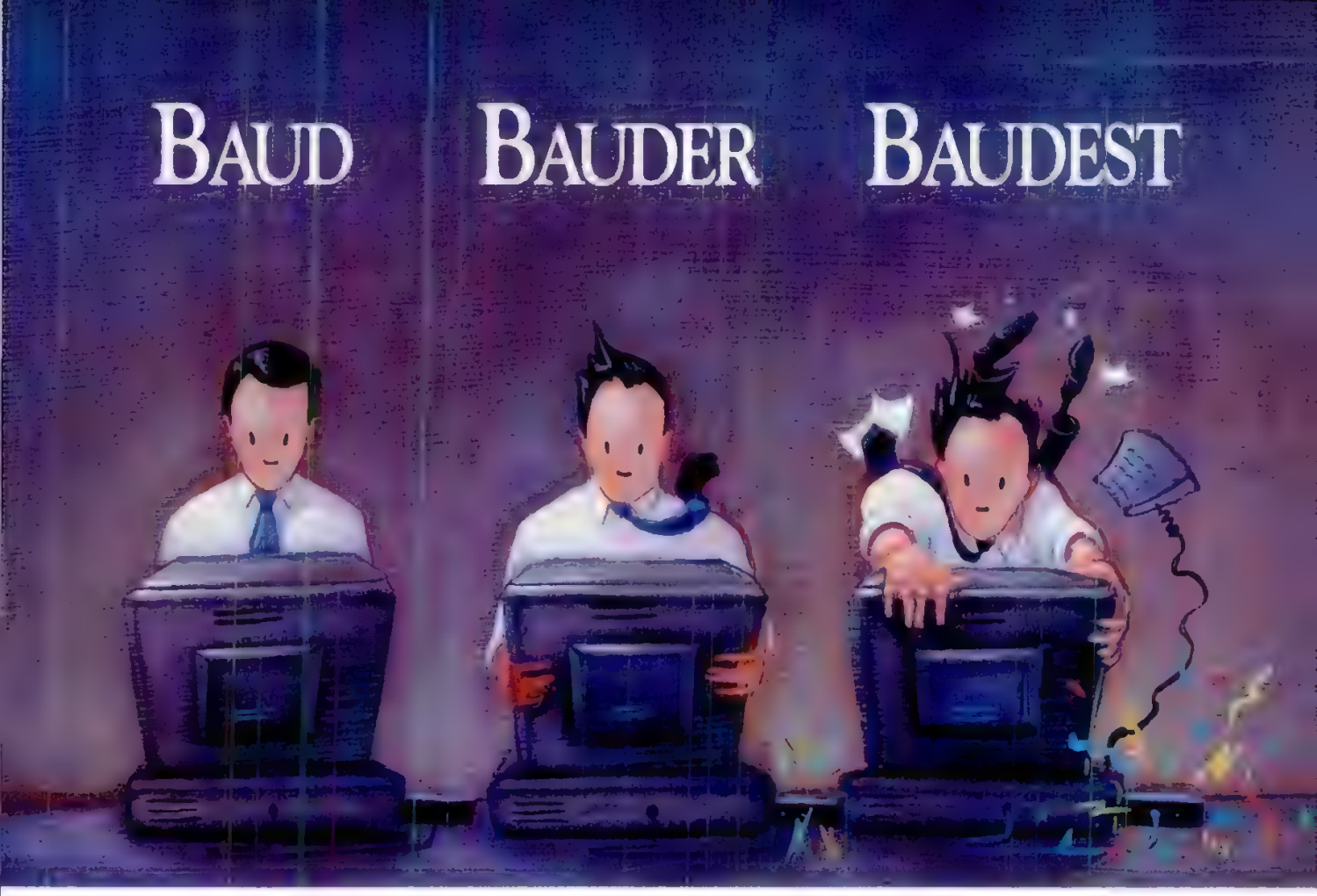
The next generation of UART, the 16550AFN, offers a neat solution to this problem: a 16-byte FIFO (first in, first out) on-board buffer. This modest chunk of memory allows the 16550AFN to keep communicating even when a multitasking computer turns its attention to other projects.

When properly programmed and using the right software (programs must be specially written to take advantage of the 16550AFN's buffer), the 16550AFN can carry out its 16 bytes of communications on its own. The chips sends or receives data on its own for up to 3 milliseconds at 38,400 bits per second—for example, while the host microprocessor engages in another task.

Because the 16550AFN is usually socket-compatible with the 16450 (check with the vendor of the board to be sure), you can easily replace the older chip with the newest one so long as the board was designed for upgradability. The sole requisite is that the 16450 in your PC or serial card be socketed rather than soldered. The upgrade is not costly and UARTs are available at retail from companies that sell individual electronic components. At the time this was written, for example, JDR Micro Devices offered the 16550AFN for $14.95. The company priced the 16450 at $10.95.

Making the upgrade in some PCs only means prying your old UART out of its 40-pin DIP socket and plugging the new one in its stead. In these machines, you would find the chip close to the port or, on a card, near the source of the port's cable. The 2.0- by 0.8-inch chip has 20 pins arranged on either side of its length. Aside from properly aligning the pins, the only complication is that you must observe the proper orientation of the chip and ensure that the notched end of your new chip points in the same direction as the old.

If you have a newer PC or serial port adapter, you may be surprised to find no UART chips in or on it at all. These products may substitute VLSI (very large-scale integration) chips that have several functions built in, including those of one or more UARTs. The Western Digital 16C552, for example, combines the electrical equivalent of two 16550AFN UARTs and a parallel port into one chip. The chip sets used to build the latest PCs typically include 16550AFN-compatible UARTs as well. You generally cannot upgrade these products—and, at least so far, you will not need to. ■



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CIRCLE 061 ON READER SERVICE CARD

gether, but only one firm fact emerged—the $1,595 AT&T Comsphere 3810 worked with every other product every time. The tests with the other products, in fact, generated such random results that we can draw no other firm conclusions. Some modems would connect when brand A called and brand B answered, but not the other way around. And some would connect when one of the pair was turned off and on before initiating the call.

The incompatibilities we uncovered did not solely involve 14,400-bps signaling; the different products often would not negotiate a connection at any speed. We expect the companies to resolve these connection problems as the months pass, but the implications are clear: Be prepared either to buy all of your modems from one vendor or to buy AT&T's high-priced yet highly compatible product.

PERFORMANCE LIMITATIONS

The more products push the performance envelope, the more they need a controlled environment. V.32bis modems require nearly perfect telephone lines and specially configured serial port connections to reach throughputs approaching 50 kilobits per second when moving a highly compressible file. Typical throughput for text files between same-brand modems hovers at around 30 Kbps.

The conditions a modem faces on any dialed-up phone call vary widely. Interestingly, some of the worst conditions can occur on calls that are considered local rather than long-distance. Local "tail" circuits seldom receive the maintenance attention given to long distance circuits, so calls within a city or regional area can traverse some of the worst line conditions. The noise and distortion on a circuit can affect both the speed of the connection the modems negotiate and the ability of the modems to move data without errors.

Error-control schemes can catch errors and request retransmission of the bad blocks, but this takes time and reduces effective throughput. On our tests, the modems from AT&T Paradyne, Motorola Codex, Hayes Microcomputer Products, and Intel handled the problems of the long local loop the best.

While most people anticipate the hostile telephone lines, the limitations built into the PC's serial port can present a surprise bottleneck. You can lose data coming from a fast modem to a PC if you do not have modern hardware. And many communications programs can deliberately slow the system's throughput for reasons once sound but perhaps now obsolete.

> The more communications products like these V.32bis modems push the performance envelope, the more they need a controlled environment.

In order to benefit from the full throughput of a V.32bis modem with V.42bis compression, the RS-232 link between the modem and the PC should run at 57,600 bits per second. However, only two of these products, the AT&T Comsphere 3810 and the Intel 14.4 EX, could run their serial ports at 57,600 bps at the time we ran our tests. (All others operated at a maximum RS-232 line rate of 38.4 Kbps.) Because of this line speed limit, these modems can not deliver data any faster to the PCs. You can use precompression to get faster effective throughput, but the modems cannot deliver data faster than their RS-232 line rate.

An even greater limitation is that the standard communications port drivers for Windows and OS/2 only allow signaling at 19,200 bps. Unless you install special products such as the $299 Hayes Enhanced Serial Port and its driver software, you will not be able to take advantage of the combined V.32bis and V.42bis throughput under these multitasking operating systems.

At the highest speed of these modems, data comes from the modem to the PC at a rate of about 5 characters per millisecond. The latest UART hardware, the 16550AFN, has a buffer able to hold 16 characters or about 3 milliseconds worth of data, if your communications software turns the buffer on—and many of us use programs a year or two old that do not activate the buffer. (See the sidebar "Meeting of Minds: Modems and the PC's UART.")

Older UART (Universal Asynchronous Receiver/Transmitter) chips such as the 8250 and 16450 have practically no buffering. The people who write communications software understand the limitations of the older UARTs and also know that some disk drive controllers block interrupts from reaching the CPU for up to four milliseconds while they access a disk sector. With interrupts blocked, the buffered data cannot move from the UART to the CPU and it is overwritten and lost. Modem error-control programs cannot control these losses because they happen in the PC.

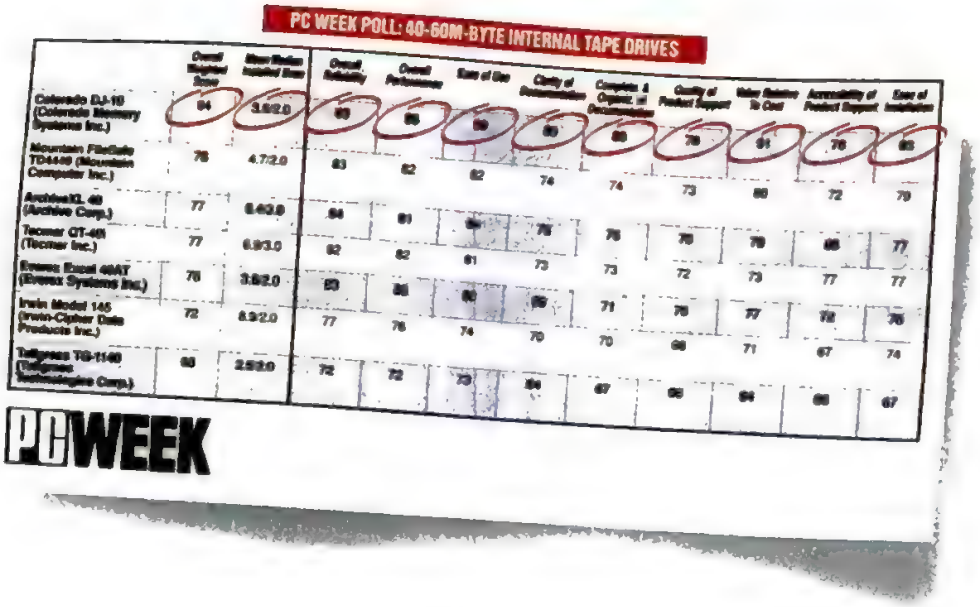
For these reasons, the communications program designers rely on a technique called hardware handshaking, which controls request-to-send signals on the RS-232 line, to slow down the data flow from the modem to the PC. These programs tell the modem to stop sending data to the PC whenever they move data to disk.

You do not buy a new expensive V.32bis modem to have a communications program slow down the data flow, however. As we close this issue, we are not ready to recommend any communications packages as a perfect match for V.32bis modems. We have planned a review of communications software for sometime before the summer, and we will spend the next few months finding the right programs for these modems.

There are two good ways to confidently take advantage of the power of V.32bis modems. The first is to use them with specialized communications boards, which work beautifully over LAN-to-LAN connections using high-speed interfaces such as the bridges and routers we reviewed in our September 10, 1991 issue. With these boards, you can take advantage of the low cost of dial-up service while still moving data between LANs at useful speeds. The other way is to precompress files before transmission using any of the popular programs mentioned earlier.

If you want to move data between standalone PCs, the best technique is to ensure you have modern UARTs in the PCs, precompress the data file, and take advantage of the V.32bis signaling rate of 14.4 Kbps with V.42 error control. The reward? Complete confidence in your communications proficiency under any computer operating system.

All wins.



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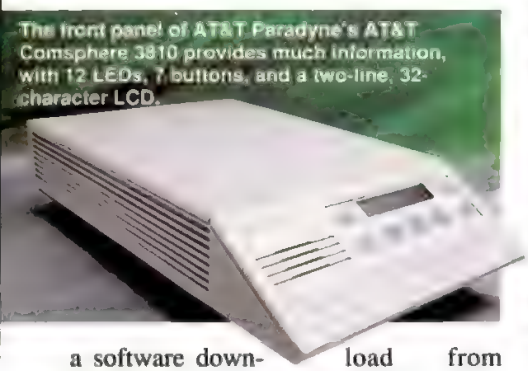
CIRCLE 026 ON READER SERVICE CARD

AT&T PARADYNE

AT&T Comsphere 3810

by M. Keith Thompson

The AT&T Comsphere 3810, from AT&T Paradyne, is the ultimate modem. AT&T knows more about sending data over two wires than any other company, and the Comsphere puts this technology to work. You can enhance and update the unit with a software download from AT&T Paradyne over a telephone line, which allows you to keep up with the latest firmware versions without sending in the modem to be upgraded. If you are in the market for a high-end modem, do not let the Comsphere's $1,595 list price keep you from giving it serious consideration.


The front panel of AT&T Paradyne's AT&T Comsphere 3810 provides much information, with 12 LEDs, 7 buttons, and a two-line, 32-character LCD.

Though a little on the large side, the Comsphere uses little power and does not get hot. The components operate in a 2.2- by 7.6- by 12-inch (HWD) gray high-impact plastic case.

All connections at the rear of the modem are clearly labeled. The unit includes a connector you can use to feed data to a remote network management system, reporting the modem's status (over a separate data bus) to a PC running the Windows-based *Dial Network Management System* (*DNMS*) software. Among other functions, *DNMS* tracks real-time alert activity and modem usage statistics in a SQL database.

The Comsphere's front panel provides as much information as any modem we tested, with 12 LEDs, 7 buttons, and a two-line, 32-character LCD. This may seem like overkill, but each feature is easy to use and understand. None of the LEDs indicates the modem's connection speed, but the LCD displays the modulation speed and the type of error control and compression being used.

Straight from the package, the Comsphere is set to run at full speed. The DTE (data terminal equipment) speed locks at 57,600 bits per second (only the Intel 14.4 EX modem also does this). The modulation rate starts at 14,400 bps with error control and compression and is negotiated down to match the other modem. To handle error-free links, the modem defaults to hardware flow control.

Flexible configuration options allow the Comsphere to fit into almost any environment. It comes standard with 4 preset configurations, 3 more configurations that are user-defined, and 10 stored phone number locations.

The unit supports V.25bis dialing commands and ATL commands to control the speaker, but the modem does not have a manual volume control. It also supports two- and four-wire leased lines and works synchronously as well.

COMPATIBILITY LEADER

On our tests, the Comsphere closely matched the AT command set of a Hayes Smartmodem 2400. Setting your communications software to a Hayes Smartmodem 2400 or "Other Hayes Compatible" setting should provide trouble-free transmissions. The only communications program it had trouble with was *Smartcom II*, Version 2.0.

The Comsphere led the pack in compatibility with other V.32bis modems: It worked all the time with every other modem. One of the fastest modems, the Comsphere held to around 3,500 characters per second when transmitting text files and moved .ZIP data files at 1,600 cps or greater under all line conditions.

The Comsphere's adequate security features include callback security and remote access via a password. A remote user can make changes to the settings and store them in one of the configuration profiles, saving significant travel time and money if the modem is unattended.

The user guide is superb, presenting a wealth of information concisely and accurately. AT&T Paradyne also offers top-of-the-line technical support and a convenient upgrade policy. The AT&T Comsphere 3800 Series modems' design allows the code in the modem to be changed remotely when you place a call to an AT&T Paradyne update center. The unit includes a two-year, return-to-the-factory warranty with a one-day turnaround time, along with no-charge remote firmware updates during the two-year warranty period. Costs vary for optional upgrades.

AT&T Paradyne provides a complete package. The AT&T Comsphere 3810 combines excellent Hayes AT compatibility and superior performance with the utmost reliability. If you need a V.32bis modem now and can foot the bill, you can't go wrong with this modem.

FACT FILE
EDITORS' CHOICE

AT&T Comsphere 3810
AT&T Paradyne, 8545 126th Ave. N., Largo, FL 34649-2826; 800-482-3333, 416-494-0453.
List Price: $1,595.
In Short: The AT&T Comsphere 3810 is an excellent modem suitable both for the desktop and for data centers. The Comsphere supports all previous modem standards, and downloadable software upgrades let you take advantage of code updates. The Comsphere's features justify its expensive price, especially its 57,600-bps transmission capability—a distinction shared only with the Intel 14.4 EX.

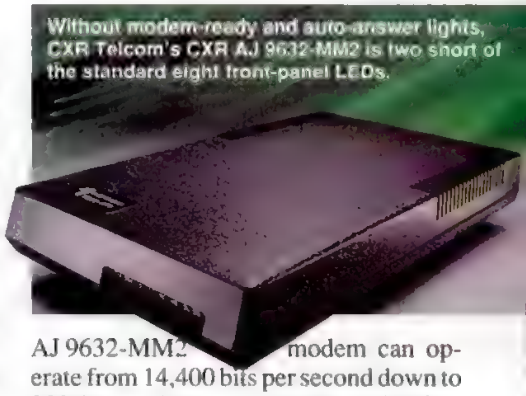
CIRCLE 473 ON READER SERVICE CARD

CXR TELCOM

CXR AJ 9632-MM2

by M. Keith Thompson

Anderson-Jacobson, a CXR Telcom company, has been making modems longer than IBM has been manufacturing PCs. CXR primarily targets the minicomputer and terminal market. Its $1,095 CXR AJ 9632-MM2 modem can operate from 14,400 bits per second down to 300 bps and has excellent security features. But although the modem we tested included V.32bis and AT command capability, it was not ready for the PC desktop.


Without modem-ready and auto-answer lights, CXR Telcom's CXR AJ 9632-MM2 is two short of the standard eight front-panel LEDs.

The CXR was among the midsize modems we reviewed. Made of high-impact black plastic, the rugged unit

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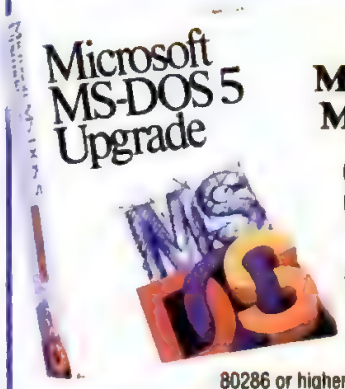

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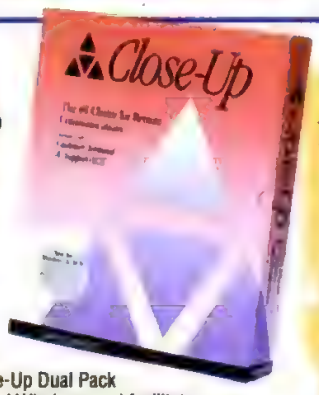

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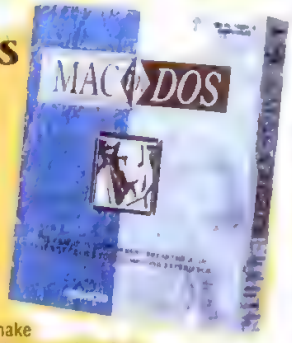

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#20304

measures 1.5 by 6.6 by 11.5 inches (HWD). It uses little electricity and does not get warm. The rear contains clearly labeled connectors, including three plugs for data line, phone, and leased-line connections.

Without modem-ready and auto-answer lights, the unit is two short of the standard eight LEDs on the front panel. A high-speed LED flashes different patterns to represent the connection rate.

Two sets of eight DIP switches inside the modem configure various communications parameters. Luckily, these switches should not have to be changed.

The CXR package contains everything to get you started except for a modem cable and communications software. You even get a phone cord with spade lugs on one end to connect to a screw-down terminal block. Directly out of the box, the CXR operates at both 9,600-bps modulation and DTE speed. The manual provides information on setting the modem for high-speed, error-controlled transmissions, but we would like to see the modem come up ready to run at its fastest possible rate.

STORED CONFIGURATION VARIETY

Five factory and five user-defined settings offer some relief from the default incompatibilities. The five preset configurations set the CXR for dial-up, four-wire leased-line originate, four-wire leased-line answer, V.25bis HDLC/SDLC (High-level Data Link Control/Synchronous Data Link Control) protocol, and V.25 BISYNC protocol modes of operation. The five user-defined settings allow ambitious users to make changes and save them for later use.

Handling high-speed data calls requires separate modem-to-modem and modem-to-computer rates, and the CXR meets the challenge. To reduce data errors, the modem disables the phone when the line jack is active.

The CXR passed our tests of AT command set compatibility after we made some changes to the default settings. Plan to spend time with the manual to make the unit work with your communications program. Although it has no manual volume control, the ATL command adjusts the volume nicely, and the modem accepts V.25bis dialing commands.

On performance tests, the CXR transmitted .ZIP compressed files at more than 1,600 cps and .TXT data at better than 3,000 cps under perfect and terrestrial line conditions. But the unit consistently failed to connect at a 14,400-bps signaling rate over the long local loop. CXR stated that it was working on the problem at press time.

If security is more important in your applications than Hayes AT command compatibility, the CXR may be the modem for you. Its elaborate set of remote-access security features includes callback to a predetermined phone number and two levels of password protection. Your user level, based on your password, determines whether you can change, view, or not view the remote modem's settings.

The CXR's well-organized 130-page manual is filled with useful sections. Dealers and distributors provide front-line support, and free technical support is available from CXR over a toll-free number. The warranty period lasts only one year, but CXR allows you or your reseller to install ROM upgrades at various prices.

The CXR AJ 9632-MM2 offers a broad set of security features and complies with a variety of standards. But it is better suited to the minicomputer and terminal market than to the desktop PC.

FACT FILE

CXR AJ 9632-MM2
CXR Telcom, 521 Charcot Ave., San Jose, CA 95131; 800-537-5762, 408-435-8520.
List Price: $1,095.
In Short: A high-end but mid-priced modem designed primarily for the minicomputer market, the CXR AJ 9632-MM2 offers Hayes AT command set capability, but only if you change its default settings. The product also had difficulty connecting at 14,400 bps on our long local loop hookup.

CIRCLE 474 ON READER SERVICE CARD

MODEM STANDARDS: MNP, CCITT, AND YOU

With all the standards available to modem buyers these days, it is easy to be confused by the various levels of signaling speed, error control, and data compression you can pay for. V.42, for instance, is an error-control protocol, while the similarly named V.42bis refers to data compression. The accompanying chart shows the modulation methods and in-modem protocols that you will commonly find in the units available today. Among the lowest-priced 2,400-bit-per-second products are those offering V.22bis speed and modulation with V.42bis data compression and V.42 error control.

Among Microcom's MNP (Microcom Networking Protocol) standards for modem control is MNP 5, which allows for an average increase in throughput of 40 percent using on-the-fly data compression. The MNP 4 standard ensures a high-quality connection through Adaptive Packet Assembly, a method that sends packets sized to match the quality of the connection: The better the connection, the larger the packet sent. Microcom's standards 5 and up are proprietary and thus must be licensed by other modem vendors. The CCITT, however, has developed modem signaling and control standards on an international scale.

SIGNALING SPEED	DATA COMPRESSION	ERROR CONTROL
V.22bis A scheme that governs full-duplex signaling rates of 1,200 and 2,400 bps.	**MNP 5** Microcom's proprietary, licensed protocol, capable of transmitting data in ⅔ the original time.	**MNP 2, 3, and 4** Three levels of a public-domain error-control scheme from Microcom.
V.32 A standard that governs full-duplex signaling at 4,800 and 9,600 bps.	**V.42bis** An international standard that allows a data transmission in ⅓ the original time.	**V.42** A protocol that incorporates a fallback to MNP 2, 3, and 4 if LAPM, the primary protocol, is not available.
V.32bis A protocol that allows signaling at 4,800, 7,200, 9,600, 12,000, and 14,400 bps.		

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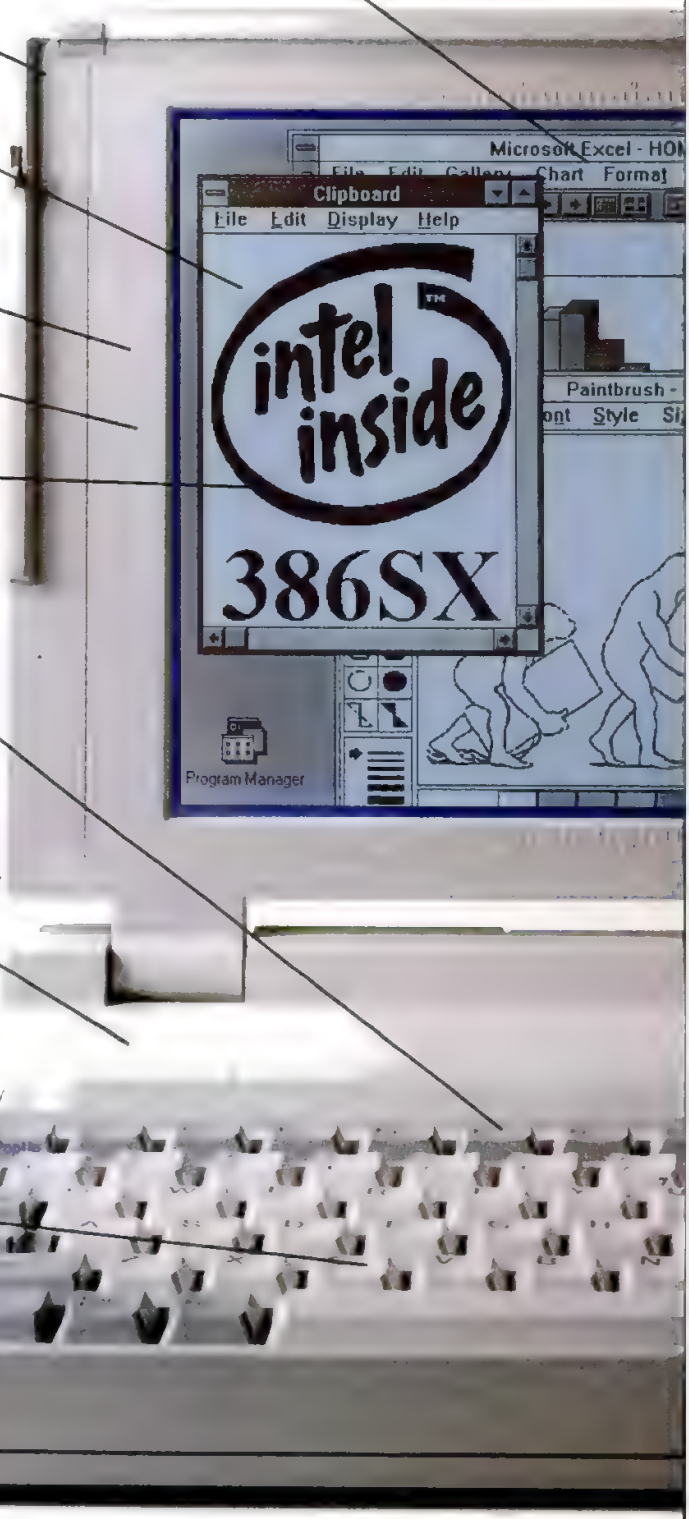

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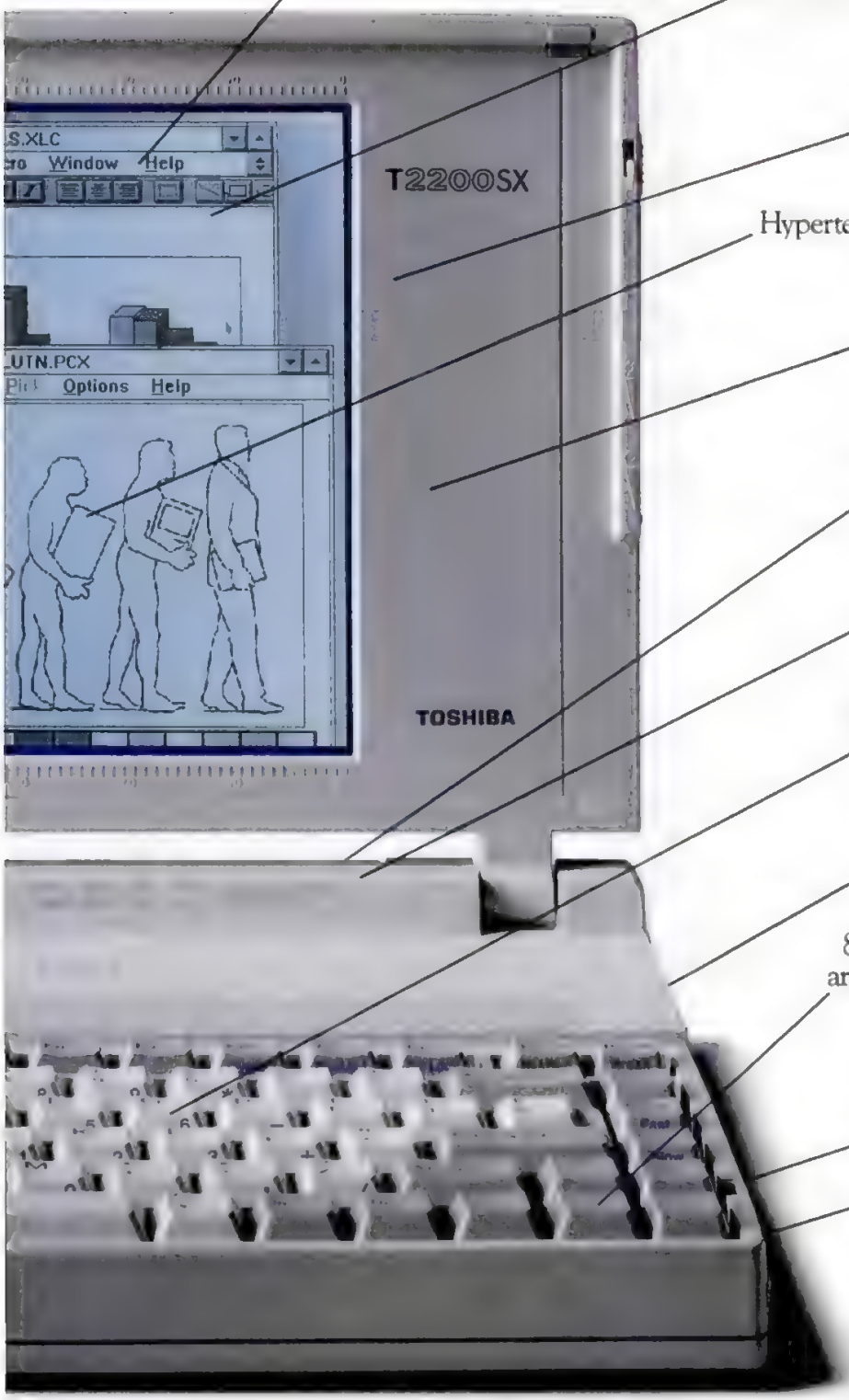

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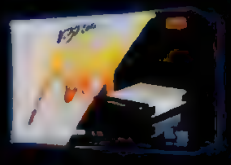

DIGICOM SYSTEMS INC.

Digicom 9624LE Plus

by Joe Salemi

At $695, the Digicom 9624LE Plus from Digicom Systems is one of the least expensive V.32bis modems in this review. Though not as feature-laden as some of the others, the Digicom has one capability that makes it stand out: Group 3 fax support. Unfortunately, the modem also suffered from performance problems when tested under degraded line conditions.

The LEDs on the front of the Digicom 9624LE Plus's metal case are easy to see from almost any angle, but the labels can be hard to read from a distance.

The Digicom's unique support for Group 3 fax could be a strong selling point for many users. The supplied *BitFax/SR* software (written by Bit Software, vendors of the *BitCom* communications package) lets you send a fax from a number of different file formats, including ASCII, TIFF, PCX, and IMG. (The communications package *QModem* is also included with the modem.) Incoming faxes are received through a TSR program that uses approximately 78K of RAM, and they are stored as TIFF files. You can use the included viewer to read, flip, rotate, or print received faxes. And you can set the modem to receive fax only, data only, or a combination.

The LEDs on the front of the metal case are easy to see from almost any angle, but the labels are dull gray and hard to read from a distance. A spring-loaded switch on the front toggles the modem between originate and answer modes, and hangs up the modem while the modem is connected (in the place of a software-initiated command). The rear panel includes an on/off switch, labeled RJ-11 phone jacks, and a row of eight DIP switches. You use one of the DIP switches to change the modem to dumb mode for large systems or terminals. The metal case serves as an excellent heat-sink and it remains cool to the touch. An internal model (not reviewed here) is available for $665.

UNIQUE COMMANDS AND MESSAGES

The manual is well organized and indexed, and the modem is set for complete V.32bis compatibility right out of the box. An appendix lists the differences in commands between this modem and the V.32 model that the manual is written for. Its command set is compatible with the Hayes Smartmodem 2400 "AT*x*" and "AT&*x*" commands; however, its extended commands use the format "AT**xx*" instead of the more common "AT%*xx*" or "AT*xx*".

Also unique is its use of "EC" after the "CONNECT <speed>" message to indicate an error-controlled connection, rather than the more common "/REL" or "/ARQ" return codes; some communications programs may have to be reconfigured to understand this message. You

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NEW!	Back-UPS 450	Tower 386, 486 systems, servers	$329
NEW!	Back-UPS 600	Heavily configured systems, CAD/CAM workstations	$449
	Back-UPS 800RT	Multiple systems, longer runtime applications	$899
	Back-UPS 1200VX	Multiple systems, LAN hubs, small minis, telecom equipment	$1199

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CIRCLE 162 ON READER SERVICE CARD

can add the type of error control in effect to the message by sending the AT*M2 command. You should also be aware that the Digicom defaults to XON/XOFF flow control, instead of the hardware flow control (RTS/CTS) necessary for reliable high-speed communications. You should send the command to change this to the modem and save it in the user-default configuration before attempting V.32bis connections. The product includes call-back security features.

The modem worked with all our test communications programs when they were set in Hayes-compatible mode, except *Smartcom II* and both versions of *Smartcom III*.

On our performance tests, the Digicom showed a marked deterioration of throughput when used with less-than-perfect lines. It worked very well with precompressed files under perfect line conditions but slowed to less than 1,400 characters per second on the simulated terrestrial line and to only 846 cps over the difficult long local loop circuit. It matched the speed of the leaders under perfect line conditions but fell back to just under 3,000 cps while moving .TXT files on the terrestrial line and to well under 2,000 cps on the long local loop. As of press time, the company was testing a new version of its firmware.

Digicom provides toll-free technical support and a five-year parts-and-labor warranty. The Digicom 9624LE Plus is a solid, inexpensive V.32bis modem that will fill the needs of casual users, who will not be affected as much by its performance problems as those with critical wide area networking needs. Home-based office workers, small businesses, and other budget-conscious users may find that the Group 3 fax capabilities combine different communications needs into an appealing package.

FACT FILE

Digicom 9624LE Plus
Digicom Systems Inc., 188 Topaz Street, Milpitas, CA 95035; 408-262-1277.
List Price: $695 (includes *BitFax/SR* and *QModem* software). Digicom 9624PC Plus (asynchronous internal model), $665.
In Short: With the addition of Group 3 fax software and support, this inexpensive no-frills V.32bis modem may appeal to those trying to save the cost of a separate fax card. But the Digicom 9624LE Plus suffered performance problems during testing under degraded line conditions.

CIRCLE 475 ON READER SERVICE CARD

GVC TECHNOLOGIES INC.

GVC SM144V

by M. Keith Thompson

In the past, GVC Technologies focused most of its attention on the OEM (original equipment manufacturer) market, but in recent years, the company has begun to market modems and computers under its own label. At $659, the GVC SM144V offers good value, especially if you do not need password security.

The GVC unit's appearance matches the traditional gray and beige of IBM computers. Its case, constructed with solid metal and a plastic face plate, measures 1.5 by 5.5 by 9.5 inches (HWD). The rugged design fits well into the desktop environment.

The rear of the GVC unit contains clearly labeled connections, including two phone plugs and a power switch. The modem uses very little power and produces only a small amount of heat.

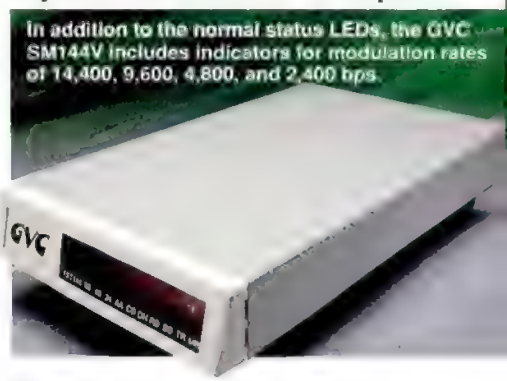
LEDs are among the modem's strong suits. In addition to the normal status LEDs, the GVC includes indicators for modulation rates of 14,400, 9,600, 4,800, and 2,400 bps. The TST light indicates an error-control link and blinks when the modem is correcting errors, a useful feature for determining the quality of the line. The GVC's only jumper block forces the modem into dumb mode, restricting all of its result codes. The jumper is conveniently located under a sliding door on the front cover.

You will find all the basic necessities in the package. Simply add a serial cable, connect to your computer, and off you go. The factory configuration sets the unit for a 14,400 modulation rate between modems and a 38,400-bit-per-second DTE speed between the modem and computer. This is somewhat limiting in that the GVC modem cannot operate at the maximum V.32bis speed of 57,600 bps (with V.42bis compression) because, as with most modems reviewed here, the fastest DTE speed is 38,400 bps. (The company expects the unit to offer 57,600 bps by the time you read this.) Over a good connection, however, this modem operates well.

FLOW CONTROL CHOICES

The GVC modem includes three factory configurations. The default configuration sets the modem for V.42bis/MNP 5 with hardware flow control (RTS/CTS). It also provides four memory locations for stored phone numbers, which allows easy dialing to the same numbers.

The GVC takes care of the details of modem operation. It implements the V.25bis dialing commands and adjusts the volume of the speaker with the ATL command. You can tell the modem to use a specific modulation rate for the phone line that is different from the modem-to-computer DTE speed. To avoid trouble, the modem disconnects the phone socket from the phone line when the modem goes off hook.



In addition to the normal status LEDs, the GVC SM144V includes indicators for modulation rates of 14,400, 9,600, 4,800, and 2,400 bps.

In our AT command set test, the GVC handled AT commands comparably to the Hayes Smartmodem 2400. The GVC worked with all communications programs we set up to run with a Hayes Smartmodem 2400, except *Smartcom II*, Version 2.0. You should be able to configure your communications software for a Smartmodem 2400 or Microcom modem and get good results.

On performance tests, the GVC was among the fastest modems: it moved precompressed .ZIP data files at 1,600 characters per second or greater under all line conditions. It was also a clear choice for sending text files, holding to around 3,500 cps and above.

FACT FILE

GVC SM144V
GVC Technologies Inc., 99 Demarest Rd., Sparta, NJ 07871; 800-289-4821, 201-579-3630.
List Price: $659. GVC SM144H (asynchronous internal model), $599.
In Short: While not the best modem tested and lacking in security features, the GVC SM144V earns merit with strengths such as a five-year warranty and fast transmission under nearly all line conditions.

CIRCLE 476 ON READER SERVICE CARD

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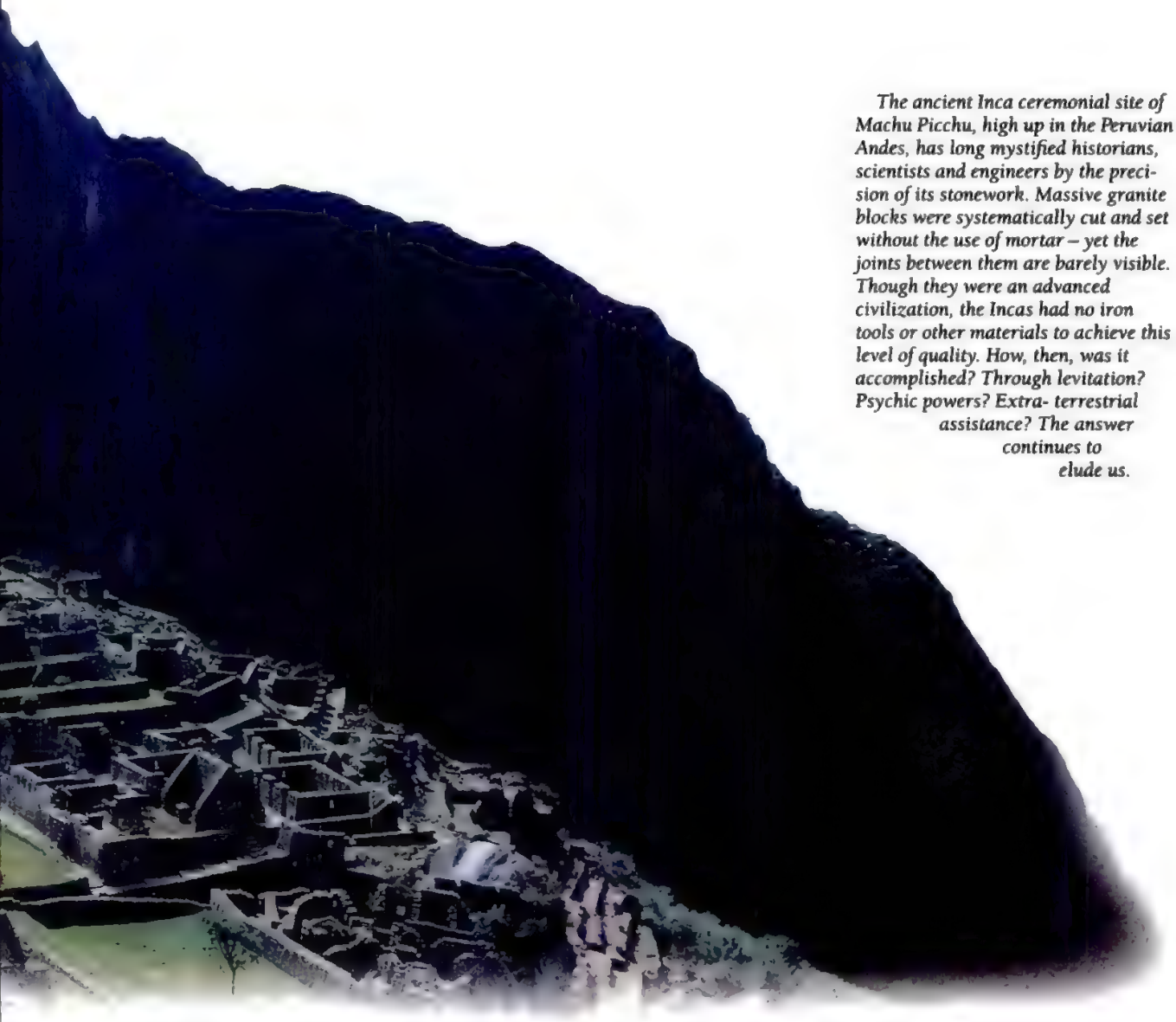

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CODE A2805

The GVC unit comes with a well-organized, informative manual, complete with useful diagrams and a quick-reference section. Dealers handle most support, but GVC also provides technical support over a toll number at no charge. With a five-year parts, labor, and ROM update warranty, GVC matches the longest warranty of any modem reviewed, and you can change the ROMs at your location.

The GVC SM144V meets the basic criteria for a V.32bis modem. It lacks password security but includes a nice set of LEDs. One of the least expensive modems we reviewed, the GVC SM144V offers good value.

HAYES MICROCOMPUTER PRODUCTS INC.

Hayes V-series Ultra Smartmodem 14400

by M. David Stone

If the Hayes V-series Ultra Smartmodem 14400 offered nothing else, the Hayes name would attract attention. Hayes Microcomputer Products has packed enough features into this modem to make it noteworthy, however. While the $1,199 list price is well into the high end among models reviewed here, Hayes modems are often discounted more heavily than less expensive brands.

As is typical with modems, the extras in the Ultra 144 are features that you either will not need at all or will find absolutely essential. For example, you may never reset the modem from its factory default AT command mode, but you can set it to wake up in dumb mode or V.25bis command mode. Or you can control its going off-hook or on-hook by an external call placement device. The modem has its own X.25 PAD for formatting the data into packets for X.25 networks. It also takes advantage of the optional V.32bis capability to monitor line quality and to request automatically a fall back to a slower speed or fall forward to a faster speed.

The modem provides four synchronous modes: manual dialing, automatic dialing of up to four stored numbers, automatic dialing under asynchronous control, and Hayes AutoSync mode, which allows asynchronous communications from terminal to modem with synchronous communications between modems.

VINTAGE HAYES

Physically, the Ultra 144 is vintage Hayes, with the same 1.5- by 5.5- by 9.6-inch (HWD) case found on most Hayes external models. The eight status lights on the front panel also match earlier models, which means you will not find any indicators for error control or data compression.

The single high-speed light comes on for any speed of 4,800 bits per second or above, so there is no easy way to see the status of any given connection. You can set the modem to report on speed, error control, and data compression before displaying the connect message on-screen; but depending on the program you use, you may not see the results. The Ultra 144 is built around a Hayes-designed chip set.

As shipped, the unit will automatically negotiate the highest common speed, er-

Several high-end features mark the Hayes V-series Ultra Smartmodem 14400, including an X.25 PAD, V.25bis support, and varied choice in synchronous modes.

WHICH COMM SOFTWARE SUPPORTS V.32BIS MODEMS?

Our reviews of modems supporting V.32bis evaluate the quality and performance of the ten included products. What is less apparent is that while V.32bis acceptance in the communications software arena is picking up steam, on-line services and the information networks lag behind in supporting high-speed communications.

We polled the communications software companies shown soon after most of these modems were introduced to the market. A *yes* indicates that the modem is listed in the software's setup configuration menu. (If the modem is not listed, the user must check the modem's user manual for a recommended choice such as "Hayes-compatible.") Most of the companies polled planned to add more V.32bis modems to their menus in the near future.

On-line services and information networks take longer to adapt to each wave of faster modems, since the vendors must choose a new set of modems (and raise their rates). We surveyed America Online, AT&T Mail, BIX, CompuServe, Delphi, Dialog, Dow Jones News/Retrieval, GEnie, Lexis/Nexis, MCI Mail, Prodigy, and The WELL. Although several of the vendors reached were known to be field-testing V.32bis modem services at the time of this writing, none yet support 14,400-bps communications.

V.32BIS MODEMS

■— Yes ⌟— No

SOFTWARE	AT&T Comsphere 3810	CXR AJ 9632-MM2	Digicom 9624LE Plus	GVC SM144V	Hayes V-series Ultra Smartmodem 14400	Intel 14.4 EX	Microcom QX 4232bis	MICC 14410/SA	Codex 3260 V.32bis	Courier V.32bis
Crosstalk Communicator	⌟	⌟	⌟	⌟	⌟	⌟	⌟	⌟	⌟	⌟
Crosstalk for Windows	⌟	⌟	■	⌟	■	■	■	⌟	⌟	■
Crosstalk Mk. IV	⌟	⌟	■	⌟	⌟	⌟	⌟	⌟	⌟	⌟
Dynacomm Asynch Edition	■	⌟	■	⌟	■	⌟	⌟	⌟	■	■
HyperAccess/5	⌟	⌟	■	⌟	■	■	■	⌟	■	■
Procomm Plus	⌟	⌟	■	⌟	■	⌟	■	■	■	■
*Smartcom Exec**	■	■	■	■	■	■	■	■	■	■
Telix SE	⌟	⌟	■	⌟	■	■	■	⌟	■	■

* Smartcom Exec supports virtually any PC modem by reading the modem's setup during installation rather than using predefined strings applicable to particular models

FACT FILE

Hayes V-series Ultra Smartmodem 14400
Hayes Microcomputer Products Inc., P.O. Box 105203, Atlanta, GA 30348; 404-441-1617.
List Price: $1,199 (includes *Smartcom EZ* 1.1).
In Short: The Hayes V-series Ultra Smartmodem 14400's premium price is justified by such premium features as V.25bis support, an X.25 PAD, and MI/MIC operation, which allows you to control the modem with an external call placement device. You may also consider this unit simply for the Hayes name, which virtually guarantees software support.

CIRCLE 477 ON READER SERVICE CARD

ror control, and data compression, and it will fall back on each feature if necessary. The Ultra 144 is also set to allow different speeds for the modem-to-modem and modem-to-computer connections, and it comes configured for RTS/CTS flow control. If you do not like these defaults, you can store two additional configurations.

Virtually any communications program designed for high speeds is likely to support the Hayes V-series modems. The Ultra 144 breezed through our test suite of programs, including *Crosstalk XVI* and *Procomm Plus*. Ironically, Hayes's own *Smartcom II* and early versions of *Smartcom III* and *Exec* would not recognize the modem at all. (The company responded that it had just begun its compatibility testing when we received our units; testing continued at press time.) *Smartcom Exec*, Version 2.1, worked without problems. The modem comes bundled with *Smartcom EZ*, Version 1.1, and can be upgraded to *Smartcom Exec* (for $35) and to *Smartcom III* (for $75).

On our performance tests, the Ultra 144 moved text files at better than 2,800 cps under all line conditions, but even under perfect conditions it did not reach the speeds set by other models reviewed. It moved previously compressed .ZIP data files at greater than 1,600 cps under all line conditions.

Support includes a two-year warranty for parts and labor and a highly welcome unlimited performance warranty that promises repair or replacement if the modem does not behave as specified in the manual. The manuals are typical for Hayes: They are well written, but the information is spread over several booklets, which occasionally makes it difficult to find the right one.

All told, the Hayes V-series Ultra Smartmodem 14400 is a typical Hayes modem, packed with premium features at a premium price. If you need any of the more sophisticated capabilities, the modem is certainly worth the extra cost. And you may find that the premium is worth paying just for the combination of Hayes support and the virtual guarantee of software compatibility.

INTEL CORP.

Intel 14.4 EX

by M. David Stone

Although Intel Corp. is better known for its computer chips or even its fax boards than for its modems, the company has consistently produced quality modems at low prices. The Intel 14.4 EX continues that tradition with a list price of $699, one of the lowest among the modems that

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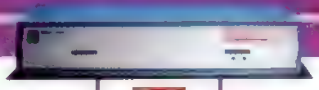

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CIRCLE 002 ON READER SERVICE CARD

have been included in this overview.

As you might expect at this price, the Intel modem does not offer any special-purpose extras such as security features or V.25bis support. You will find the usual two-wire leased-line support, and support for synchronous as well as asynchronous communications. You will also find the

The Intel 14.4 EX offers such useful features as an error-control light that also blinks to indicate data compression, and a high-speed light.

ability to lock DTE speed at 57,600 bps, a distinction the Intel unit shares only with AT&T Paradyne's AT&T Comsphere 3810.

The Intel offering is built around a Rockwell chip set inside a typical 1.5- by 5.5- by 9.6-inch (HWD) aluminum case, making it the right size to fit under a standard desktop phone. The modem runs a little warmer than most, but Intel does not seem to think that has any effect on the modem's reliability, given its relatively long three-year warranty.

HIGH-SPEED COLORS

The front panel offers all the usual status lights plus one. The addition is labeled EC for error control, but it actually shows data compression status as well by glowing steadily to indicate error control or blinking to indicate error control plus data compression. The high-speed light uses a combination of colors (red, orange, green) plus blinking patterns to indicate each different speed from 1,200 to 14,400 bits per second. This additional information is highly welcome, though it may take a while to learn how to decode the lights. The only thing you cannot tell from looking at the front panel is whether the error correction and data compression are LAPM and V.42bis or MNP 4 and MNP 5.

The modem offers a single factory setup and the ability to store two user-defined setups. The factory default sets the modem the way you are most likely to want it. Unless you change the settings, the Intel unit will automatically negotiate the fastest speed and highest level of error control and data compression, and it will fall back to lower levels for each feature if necessary.

The default settings also allow a different speed for modem-to-modem than for modem-to-computer connections, and set the modem for RTS/CTS flow control. Note that the modem also takes advantage of the optional V.32bis capability to monitor line quality and to initiate a request to fall back to slower speeds or fall forward to higher speeds as line quality changes.

Software compatibility is better than most. The Intel modem offers a superset of the Hayes Smartmodem 2400 commands, and it works with most of the software we used to test it simply by installing the software for a Hayes Smartmodem 2400. It even worked, after a fashion (at only 1,200 bps), with Hayes's *Smartcom II* and early versions of *Smartcom III* that would not work with a Hayes V-Series Ultra Smartmodem 14400 at all. Note that the Intel unit comes with *Crosstalk Communicator*, Version 2.00 (labeled as 1.0 for the Intel version), a reasonably full-function communications program.

On our performance tests, the Intel modem moved text files at around 2,500 cps under all line conditions, but even under perfect conditions it did not reach the speeds set by nearly all the other modems. (The vendor changed the modem's ROM once during testing; our scores reflect the later version.) The Intel modem did not move compressed files as fast as the leading modems did (it averaged above 1,400 cps), but it worked reliably under all line conditions.

The Intel 14.4 EX offers an attractive mix of features. You may have to look elsewhere if you need some special-purpose capability, but if you want high-speed general-purpose communications, the Intel modem is up to the task. And at $699 for a V.32bis modem, it almost qualifies as a bargain.

FACT FILE
EDITORS' CHOICE

Intel 14.4 EX
Intel Corp., PC Enhancements Division, CO3-07, 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124; 800-538-3373, 503-629-7000.
List Price: $699 (includes *Crosstalk Communicator* 2.00 and diagnostic software).
In Short: At $699, the Intel 14.4 EX almost qualifies as a bargain. Missing from the modem are high-end extras such as V.25bis support, but the product offers all the features that most users will need in a desktop modem—plus 57,600-bps transmission capability. The Intel unit also adds some nice touches such as status lights that indicate error control and data compression.

CIRCLE 478 ON READER SERVICE CARD

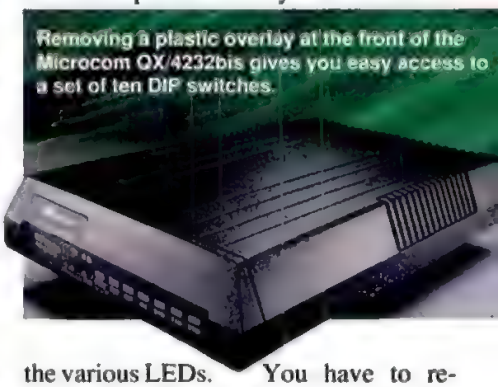
MICROCOM INC.

Microcom QX/4232bis

by Joe Salemi

The Microcom QX/4232bis, from Microcom, offers more than the usual error-control features. In addition to the error control that is part of the V.32bis standard, the $899 Microcom modem provides support for MNP 10. Setting the unit up properly can be a bit complex, but once that's done, it does its job with a minimum of fuss. The Microcom performed well on our tests, though it had some problems making 14,400-bps connections.

The front of the heavy plastic case has a flexible plastic overlay with labels for


Removing a plastic overlay at the front of the Microcom QX/4232bis gives you easy access to a set of ten DIP switches.

the various LEDs. You have to remove the overlay to access the front set of ten DIP switches. Next to the LEDs are two push-in switches that set the modem to voice or data, and originate or auto-answer.

On the rear is a second set of eight DIP switches, a recessed manual volume knob that you will need a small screwdriver to adjust, a reset switch that forces the modem to reread the switch settings, and two RJ-11 phone jacks labeled for phone and line.

Microcom's modems are intended for the entire data communications market, and you use the external DIP switches to control the modem when software control is impossible. You need to check the switches when setting up the modem; their default is for "smart terminal" or PC use. A quick-installation guide lists the default settings and provides information on setting up the modem for terminal

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to host use or configuring it for a few communications packages, such as *Carbon Copy Plus*, *Crosstalk*, and *ProComm Plus*. The reference manual and quick-reference card give information on the different settings, the internal jumpers used for changing the way the various RS-232 pins function, and the software command set. The base command set is similar to the Hayes Smartmodem 2400 "AT*x*" and "AT&*x*", with Microcom's "AT*xx*" and "AT%*xx*" extensions.

The documentation we received was for the Microcom QX/4232hs V.32 modem, with a 20-page QX/4232bis addendum. The reference manual is well organized with both a table of contents and an index, but having to switch constantly between the manual and the addendum to get all the settings right made setup tedious. Fortunately, the modem's defaults are set for proper V.32bis operation, so you only have to adjust the software commands for special circumstances or more-detailed connect responses.

The modem worked fine with our test communications programs, except for *Smartcom II* and *Smartcom III*, Version 1.0. *Smartcom III*, Version 2.0 required some adjusting. On our performance tests, the Microcom neared or surpassed its competitors' performance by moving pre-compressed .ZIP files at better than 1,700 characters per second and text files at better than 3,600 cps under perfect and terrestrial line conditions. It failed to connect, however, at a 14,400-bps signaling rate over the long local loop.

Microcom showed us additional units with modified firmware that was more conservative about upshifting speed. With our test units, the modems would upshift, bog down, and upshift soon after if it met with no errors. The new units, though, were slower at upshifting after bit errors caused a reduction, resulting in a marked difference in long-term throughput. Our test results thus reflect the performance of the original firmware, not the experimental upgrade.

EXTRA ERROR CONTROL

Microcom has included MNP Classes 6, 7, and 10 in the Microcom unit; MNP 10 is designed for operation under very poor line conditions, through use of Adverse Channel Enhancements (ACE) that let the modems dynamically adjust their modulation speeds to compensate. The Microcom modem also supports synchronous communications.

Microcom supplies a one-year parts-and-labor warranty, along with free technical support at a toll number weekdays from 7 A.M. to 7 P.M. E.S.T. Customers can install minor firmware upgrades themselves, but if the upgrade is major, Microcom will recall the modem.

The Microcom QX/4232bis is a

FACT FILE

Microcom QX/4232bis
Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062; 617-551-1000.
List Price: $899 (includes *Carbon Copy Plus* remote-control software).
In Short: The Microcom QX/4232bis is a middle-of-the-road V.32bis modem with features that make it ideal for a variety of uses such as point-to-point communications. Its strengths include security and external configuration control, but the product had problems with our long local loop connection.

CIRCLE 480 ON READER SERVICE CARD

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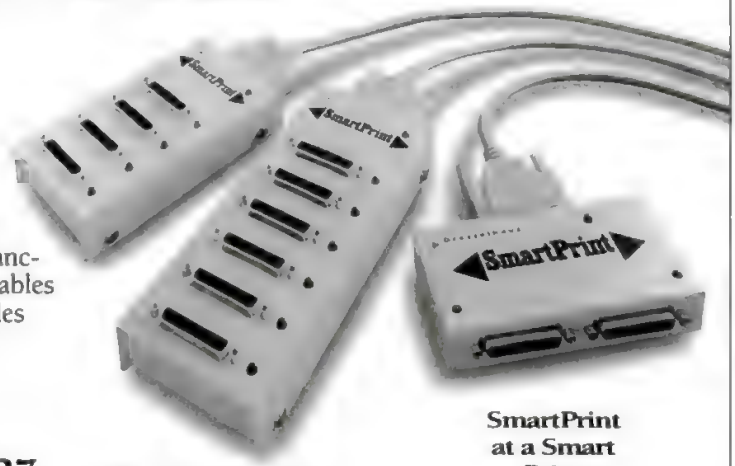

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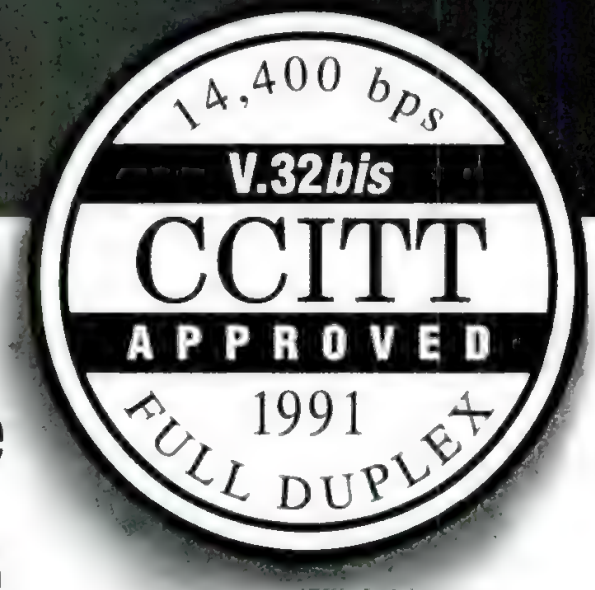
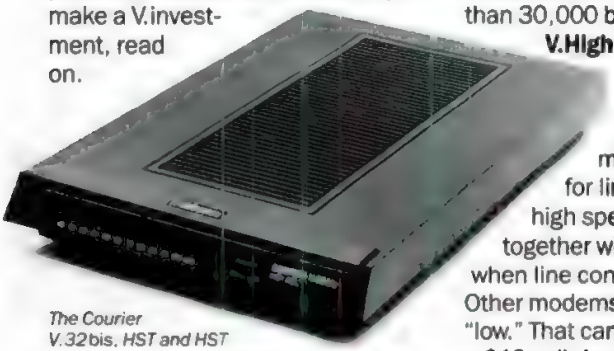
CIRCLE 150 ON READER SERVICE CARD



Avoid Modem V.Obsolescence

V.32 modems are now V.obsolete. That's right, just when you thought it was safe to standardize on V.32s, the CCITT officially approved the standard for a greatly improved product, the V.32*bis*. So before you make a V.investment, read on.



The Courier V.32bis, HST and HST Dual Standard modems are all available in internal, external and rackmount models.

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V.32*bis* is 14,400 bps full duplex. It's 50% faster than a V.32, and 6 times faster than 2400 bps modems. When you add CCITT-standard V.42*bis* data compression, as in our Courier Dual Standard™ and V.32*bis* modems, you get true 38,400 bps throughout. And that's V.whoosh. With regular V.32 modems, real throughput is less than 30,000 bps.

V.High Performance

ASL™ is U.S. Robotics' Adaptive Speed Leveling. All modems slow down for line noise. But two high speed Couriers working together will speed up again when line conditions improve. Other modems leave you stuck in "low." That can turn a $1 call into a $10 call. And that's V.robust for V.savings.

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U.S. Robotics pioneered V.32*bis*. In fact, we've been shipping V.32*bis* products since last year to some of the largest companies in the world, including DuPont, Kodak, U.S. West, and CompuServe. With U.S. Robotics modems, these companies can V.forget about the hassles of high speed data communications, forget about line noise, and forget about resending data. In addition, they can forget about investing in V.obsolescence. And so can you.

The standard: Courier V.32bis with ASL.™

When you need to move up to high speed modems, insist on V.32*bis* and U.S. Robotics.

1-800-DIAL-USR. In Canada: 1-800-553-3560. In the U.K.: Miracom Technology, Ltd., 0473 233-88. Or write: U.S. Robotics, Inc., Attn: Marketing Dept., 8100 N. McCormick Blvd., Skokie, IL 60076.

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CIRCLE 231 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in ascending price order

PC MAGAZINE

PC—Editors' Choice
■—Yes ❑—No

	GVC SM144V	Digicom 9624LE Plus	Intel 14.4 EX	Microcom QX/4232bis	Courier V.32bis
List price	$659	$695	$699	$899	$995
Software included	None	*Qmodem, BitFax/SR*	*Crosstalk Communicator* 2.00, diagnostic software	*Carbon Copy Plus*	None
PHYSICAL FEATURES					
Chip set manufacturer	Rockwell	Digicom Systems	Rockwell	Rockwell	U.S. Robotics
Dimensions (HWD)	1.5 x 5.5 x 9.5	1.5 x 6.3 x 10	1.5 x 5.5 x 9.6	2 x 7 x 10.8	1.6 x 8.3 x 12.7
Cabinet material	Metal	Metal	Metal	Plastic	Plastic
LEDs:					
Number	12	8	9	7	12
Labels	AA, CD, OH, RD, SD, TR, MR, TST, 144, 96, 48, 24	MR, TR, CD, SD, RD, HS, AA, OH	HS, AA, CD, OH, RD, SD, TR, MR, EC	PWR, TST, OH, HS, DTR, TXD, RXD	HS, AA, CD, OH, RD, SD, TR, MR, RS, CS, Syn, ARQ
On/off switch	■	■	■	❑	■
Location	Rear	Rear	Rear	N/A	Rear
Data/voice switch	❑	■	❑	■	■
Location	N/A	Front	N/A	Front	Front
Manual volume control	❑	❑	❑	■	■
Location	N/A	N/A	N/A	Rear	Front
Type	N/A	N/A	N/A	Screw slot	Dial
Modular phone plug jacks:					
Location	Rear	Rear	Rear	Rear	Rear
Jacks for connecting telephones	1	1	1	1	1
Jacks for connecting telephone lines	1	1	1	1	1
Separate jack for leased line	■	❑	❑	❑	❑
All jacks interchangeable	❑	❑	❑	❑	❑
All jacks labeled	■	■	■	■	■
Inactive jack dead during session	■	■	■	■	■
Printed commands on bottom of modem	❑	❑	❑	❑	■
Uses DIP switches	❑	■	❑	■	■
AA	N/A	❑	N/A	❑	■
CD	N/A	■	N/A	■	■
CTS	N/A	❑	N/A	❑	❑
DTR	N/A	❑	N/A	■	■
RTS	N/A	❑	N/A	❑	❑
Others	N/A	■	N/A	■	■
Dip switch location	N/A	Rear	N/A	Rear (open), front (under thin cover)	Rear
Jumpers on board	■	❑	❑	■	❑
AT COMMANDS					
Uses AT commands	■	■	■	■	■
Accepts only uppercase commands	❑	❑	❑	❑	❑
Accepts upper- or lowercase commands separately	■	■	■	■	■
Accepts mixed upper- and lowercase commands	❑	❑	❑	❑	❑
AT dial commands supported:					
D (dial)	■	■	■	■	■
, (pause)	■	■	■	■	■
T (touch-tone)	■	■	■	■	■
P (pulse)	■	■	■	■	■
R (reverse)	■	■	■	■	■
; (return to command state after dialing)	■	■	■	■	■
0–9, *, and #	■	■	■	■	■
! (flash for PBX)	■	■	■	■	■
/ (1/8-second pause)	❑	❑	❑	❑	■
@ (wait for silence)	■	■	■	■	■
W (wait for second dial tone)	■	■	■	■	■
ABCD (for number)	■	■	■	❑	❑

N/A—Not applicable: The product does not have this feature.

MiCC 14410/SA	CXR AJ 9632-MM2	Codex 3260 V.32bis	Hayes Smartmodem 14400	AT&T Comsphere 3810
$999	$1,095	$1,195	$1,199	$1,595
None	None	None	*Smartcom EZ* 1.1	None
Rockwell	Phylon	Motorola Codex	Hayes	AT&T
1.8 x 6.4 x 10.3	1.5 x 6.6 x 11.5	2.6 x 6.8 x 9.6	1.5 x 5.5 x 9.6	2.2 x 7.6 x 12
Metal	Plastic	Plastic	Metal	Plastic
8	6	6	8	12
HS, AA, CD, OH, RD, SD, TR, MR	DTR, DSR, CD, TD, RD, HS	CD, OH, RD, SD, TR, RC/NC	HS, AA, CD, OH, RD, SD, TR, MR	PWR, ALRM, DIAG, DTR, RTS, CTS TXD, LSD, RXD, SQ, TEST, RATE
■	■	■	■	■
Rear	Rear	Rear	Rear	Rear
⌟	⌟	■	⌟	⌟
N/A	N/A	Front	N/A	N/A
⌟	⌟	⌟	⌟	⌟
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A
Rear	Rear	Rear	Rear	Rear
1	1	1	1	1
1	1	1	1	1
■	■	❑	❑	■
⌟	⌟	⌟	⌟	⌟
■	■	■	■	■
■	■	■	■	■
❑	❑	❑	❑	⌟
■	■	■	■	⌟
■	❑	❑	❑	N/A
■	■	❑	❑	N/A
❑	■	❑	⌟	N/A
■	■	❑	❑	N/A
❑	❑	❑	❑	N/A
■	■	■	■	N/A
Inside	Inside	Rear	Behind front panel	N/A
⌟	⌟	⌟	■	⌟
■	■	■	■	■
❑	❑	❑	❑	❑
■	■	■	■	■
❑	❑	❑	❑	❑
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■

CONTINUES

middle-of-the-road V.32bis modem that is sufficient for use in a wide variety of communications despite the problems it faced on our tests. Its real strengths lie in the area of dedicated point-to-point communications, as in LAN-to-LAN connections, where security and external configuration control as well as the enhanced error control offered by MNP 10 are significant factors.

MICRO INTEGRATED COMMUNICATIONS CORP.

MiCC 14410/SA

by M. Keith Thompson

Micro Integrated Communications Corp.'s MiCC 14410 series falls near the high end of the vendor's desktop product line. The company's MiCC 14410/SA modem includes a good set of security features. But at $999, the unit only fits in the middle of the pack on price and had difficulty with some of our tests.

The MiCC modem comes with the basic set of components in a compact

The MiCC 14410/SA includes the standard eight status lights on the front panel, but none extra to indicate modulation rate or error control.

package, but our test unit did not include a power switch or manual volume control. (Models with and without these features are available.) The attractive gray-colored unit measures 1.8 by 6.4 by 10.3 inches (HWD) and fits nicely on a desktop. Housed in a rugged case made of sturdy metal and a plastic face plate, the MiCC modem generates only a small amount of heat.

The rear of the modem holds all the connectors, including three clearly labeled plugs for line, phone, and leased-line connections. The MiCC includes the standard complement of eight status lights on the front panel. But since the modem supports many different speeds, we would like to see more lights to indicate the modulation rate and error control. A toggle switch on the front panel tells the modem

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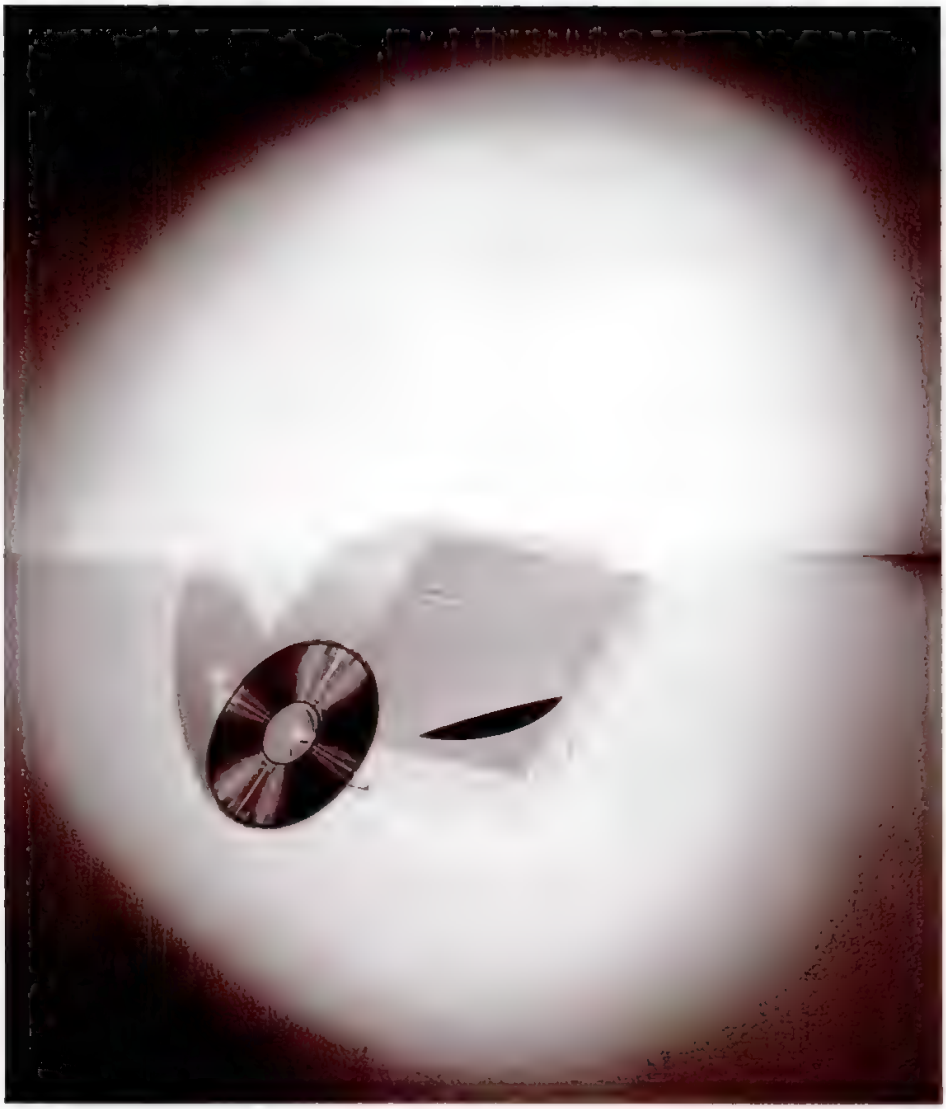

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CIRCLE 375 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in ascending price order

PC—Editors' Choice
■—Yes ❑—No

	GVC SM144V	Digicom 9624LE Plus	Intel 14.4 EX (PC)	Microcom QX/4232bis	Courier V.32bis
AT COMMANDS (continued)					
Extended AT set: S (dial stored number)	■	■	■	■	■
Hayes modem that most closely resembles the unit's AT command set	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400
Number of factory setup strings	3	1	1	1	1
Number of user setup strings	2	1	2	8	1
CUSTOMIZATION					
Buffer memory for transmit and receive	32.5K	112K	3K	40K	1.75K
Remote access	❑	❑	❑	■	❑
Remote control	❑	❑	❑	■	❑
Remote diagnostics	❑	■	■	■	■
Number of phone numbers storable	4	10	4	9	4
Can secure list of numbers	❑	■	❑	❑	❑
SELF TESTS					
Local analog loopback	■	■	■	■	■
Local digital loopback	■	■	■	■	■
Remote analog loopback	■	❑	■	❑	■
Remote digital loopback	■	■	■	■	■
Test pattern generation and checking	■	■	■	■	■
Power-on self-test	■	■	■	■	■
USAGE					
Manual dial	■	■	■	■	■
Manual answer	❑	■	■	■	■
Supports V.25bis autodial	■	❑	❑	❑	❑
Automatic feature negotiation	■	■	■	■	■
Call Progress monitoring:					
Dialtone detect	■	■	■	■	■
Busy detect	■	■	■	■	■
Voice detect	❑	❑	❑	❑	■
Other	❑	❑	■	■	■
Leased-line capabilities:					
2-wire	■	■	■	■	■
4-wire	❑	❑	❑	❑	❑
Provides auto-dial backup if line fails	❑	❑	❑	❑	❑
Can set for constant DTE speed	■	■	■	■	■
FLOW CONTROL					
XON/XOFF	■	■	■	■	■
RTS/CTS	■	■	■	■	■
ENQ/ACK	■	■	❑	■	■
ERROR CONTROL PROTOCOLS					
MNP 2, 3, and 4	■	■	■	■	■
V.42	■	■	■	■	■
Other	None	None	None	None	None
DATA COMPRESSION PROTOCOLS					
MNP 5	■	■	■	■	■
V.42bis	■	■	■	■	■
Directory size (bytes)	2,048	2,048	1,536	1,024	2,048
Maximum string (bytes)	32	32	250	250	32
Other	None	None	None	MNP 7	None
MODULATION PROTOCOLS					
Bell 103J	■	❑	■	■	■
Bell 212A	■	■	■	■	■
HST	❑	❑	❑	❑	❑
V.21	■	❑	❑	❑	■
V.22	■	■	■	■	■
V.22bis	■	■	■	■	■
V.23	■	❑	❑	❑	❑
Other	None	None	None	None	None

MiCC 14410/SA	CXR AJ 9632-MM2	Codex 3260 V.32bis	Hayes Smartmodem 14400	AT&T Comsphere 3810
■	■	■	■	■
Smartmodem 2400	Smartmodem 2400	Smartmodem 2400	Ultra 9600	Smartmodem 2400
1	5	4	1	4
1	5	4	2	3
64K	6K	20K	0.5K	15K
■	■	■	□	■
■	■	■	□	■
■	■	■	■	■
4	100	9	4	10
■	■	■	□	■
■	■	■	■	■
■	■	■	■	■
■	□	□	□	□
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
□	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
□	□	□	□	□
□	□	□	□	■
■	■	■	■	■
■	■	■	□	■
■	■	■	□	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
□	□	□	□	□
■	■	■	■	■
■	■	■	■	■
None	None	None	Hayes LAP-B	None
■	■	■	■	■
■	■	■	■	■
4,096	1,024	2,048	1,024	4,096
32	250	250	32	32
None	None	None	Hayes proprietary, adaptive data compression	None
■	■	■	■	■
■	■	■	■	■
■	□	□	□	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
□	■	□	■	□
None	Fax, V.33	None	None	None

CONTINUES

Housed in a rugged metal case, the MiCC unit generates only a small amount of heat.

to answer or originate calls.

The MiCC modem includes two sets of DIP switches for configuring options such as asynchronous or synchronous operation, auto-answer, numeric or word result codes, and smart or dumb mode. To change these switches in hardware you have to take the modem apart (the company recommends customers have MiCC or a distributor set the switches to your preference at purchase), but most of these options have equivalent AT commands you can issue from your communications software.

Right out of the box the MiCC unit operates at its maximum speed of 14,400-bit-per-second modulation between modems and 38,400-bps DTE speed between the modem and computer. The 38,400-bps DTE speed limitation, however, prevents the 57,600-bps throughput available under the V.32bis specification. (MiCC expected the MiCC 14410/SA to offer 57,600-bps throughput in January 1992.)

Unlike most modems we tested, the MiCC only includes one set of factory defaults and one customized set, which limits its flexibility. It comes with carrier detect and data terminal ready settings automatically turned on, but most communications programs will detect this and change the settings to meet their requirements.

FACT FILE

MiCC 14410/SA
Micro Integrated Communications Corp., 3255 Scott Blvd., Bldg. 3, #102, Santa Clara, CA 95054; 800-282-6422, 408-980-9565.
List Price: $999.
In Short: A run-of-the-mill V.32bis modem with above-average Hayes AT compatibility, the MiCC 14410/SA includes remote access and password security. But the MiCC's poor performance on our long local loop connection makes us reluctant to recommend it.

CIRCLE 478 ON READER SERVICE CARD

Just OK.

$1249

HP® LaserJet® IIP+

Printhead warranty: 1 year
Conventional laser printhead
14 fonts, 2 typefaces
70-sheet paper tray
Curved paper path
Height: 8¼"

At $999 list, there's no lower priced page printer on the market than the Okidata OL400.* Yet it offers many features you won't find on the $1249 LaserJet IIP+.

Our solid-state LED printhead, for example, has *no* moving parts. It's so reliable, it comes with a 5-year warranty—longest in the industry (plus 1 year parts and labor on the printer itself).

Okidata's simpler printhead costs less to manufacture, and results in a simpler design overall—a major reason for the OL400's low cost. It also comes with more typefaces and fonts, and a high-capacity paper

Okidata OK!™

$999 Okidata OL400

Printhead warranty: 5 years
Okidata-built LED printhead
(no moving parts)
17 fonts, 4 typefaces
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200-sheet paper tray
Straight-line paper path–
feeds envelopes, labels,
heavy stock without jamming
Low profile: 5½"

tray—all standard. And unlike the LaserJet, Okidata gives you your choice of parallel or serial interface.

And the OL400 has one more unique feature—the Okidata OK! It's our promise that every printer we sell will deliver not merely acceptable performance and good value, but outstanding performance and exceptional value.

So before you settle for a page printer that's merely OK, visit your authorized Okidata dealer and ask about the printer that's Okidata OK!—the Okidata OL400.

For further information, call 1 (800) OKI-DATA.

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OKI OK!

OKIDATA OK!

*Manufacturer's suggested retail price. Dealer prices may vary. HP and LaserJet are Reg TM of the Hewlett-Packard Corporation. Okidata is a Reg TM and Okidata OK is a TM of OKI Electric Industry Co., LTD. We don't just design it to work. We design it to work wonders. is a TM of OKI America Inc.

CIRCLE 235 ON READER SERVICE CARD

The MiCC modem handles V.25bis dialing and ATL commands for volume control, and it allows separate modem-to-modem and modem-to-computer rates. To keep you from accidentally introducing line noise by picking up the local phone, the modem disconnects the phone socket from the phone line when it goes off the hook.

HAYES AND MICROCOM COMPATIBILITY

During our AT command set test, the MiCC unit closely matched the AT commands of the Hayes Smartmodem 2400. The only program that did not work without any modifications was *Lotus Express*. By configuring your communications software for a Smartmodem 2400, you should have good success. The MiCC modem also closely follows the Microcom extended AT command set.

On our performance tests, the MiCC equaled the leading modems' speed by moving precompressed .ZIP files at around 1,700 cps and text files at better than 3,500 cps under perfect and terrestrial line conditions. But it would not connect at a 14,400-bps signaling rate over the long local loop. To its credit, the vendor appeared highly interested in testing its products as soon as possible against the latest recommendations.

> MiCC seems to be greatly interested in testing its products against the latest recommendations.

Many organizations will find the MiCC's remote-access and security features useful. Two password levels allow remote users to view or change the modem's configuration. They can also change passwords from a remote location. A callback feature hangs up the modem when users enter a password and calls them back at a predetermined phone number.

The well-organized manual is full of helpful information. MiCC supports and upgrades its products through dealers or at the factory. If you need further help, technical support is available at no charge over a toll number. The modem's warranty lasts two years after purchase. ROMs updated for bug fixes are provided at no charge during this period, but ROM prices vary for optional upgrades.

The MiCC 14410/SA meets the basic criteria for a V.32bis modem. While it does not include any bells or whistles, it does provide security options and remote access. The product's difficulty with our tests, however, indicates the MiCC 14410/SA is not your best option.

MOTOROLA CODEX

Codex 3260 V.32bis

by M. David Stone

Motorola Codex has managed to build a modem that is appropriate for both data-

SUMMARY OF FEATURES

Products listed in ascending price order

Editors' Choice
■—Yes ❑—No

	GVC SM144V	Digicom 9624LE Plus	Intel 14.4 EX	Microcom QX/4232bis	Courier V.32bis
SECURITY					
Dial-back security	■	■	❑	■	❑
Remote configuration	❑	❑	❑	■	❑
Password protection	N/A	N/A	N/A	■	N/A
Phone numbers/profiles password-protected	❑	❑	❑	❑	❑
DOCUMENTATION					
Index	■	■	■	■	■
Diagrams	■	❑	■	■	■
Cable diagrams	■	■	■	❑	■
Troubleshooting section	❑	■	■	■	■
HELP AND SUPPORT					
Tutorial manual	❑	❑	❑	❑	❑
Toll-free number	❑	■	❑	❑	■
900 number	❑	❑	❑	❑	❑
BBS	❑	■	■	❑	■
Other	None	None	CompuServe, Faxback, MCI	None	CompuServe
WARRANTIES					
Warranty (parts and labor)	5 years	5 years	3 years	1 year	2 years
Service center location	Factory	Factory	Factory	Dealer	Factory
DISTRIBUTION CHANNELS					
Dealers	■	■	■	■	■
VARs	■	■	■	■	■
Direct (through stores)	❑	❑	❑	❑	❑
Mail order	■	❑	■	❑	❑

N/A—Not applicable: The product does not have this feature.

processing departments and desktop PCs. It has also succeeded in keeping the base price of the Codex 3260 V.32bis relatively low in the DP market ($1,195 as configured, or $1,395 for a network-managed version): essentially the same premium price as the V.32bis modem offered by Hayes.

For desktop PC users, the Codex offers a high degree of compatibility with popular PC-based software. Along with Codex-specific commands, the command set is a superset of the Hayes Smartmodem 2400 commands.

The Codex worked with every program we tested it with, including versions of *Smartcom II* (at low speed) and *Smartcom III* that would not work with the Hayes V.32bis offering. (Note, however, that the modem will work at a maximum of 9,600 bits per second when auto-dialing with *Smartcom III*. According to the vendor, the modem does not support a 14,400-bps modem-to-computer connection, while *Smartcom III* looks for a response at 14,400 before it moves to the 38,400 speed that the modem does support.)

Interestingly, the Codex modem is closer in size to the typical PC-based modem than the typical oversize DP modem. At 2.6 by 6.8 by 9.6 inches (HWD), the 3.1-pound unit is just the right size to fit under a standard desktop phone.

Six status lights occupy the front of the modem, but the only missing light worth noting is for auto-answer. Much more important, you can open or remove the front cover to reveal a 16-character LCD and four control buttons that let you check the status of the modem or set the modem without giving commands from the keyboard. The extensive menu system works similarly to the menus found on most laser printers.

NETWORK AND LEASED-LINE READY

The network-managed version of the Codex unit includes two connectors on the back for daisy-chaining modems. According to Motorola Codex, this option is appropriate for networks that need up to about eight modems. If you need more than that on your network, you are better off buying the functionally identical rack-mounted Codex 3262 V.32bis, at $2,195 for a dual-modem card. The Codex 3261 V.32bis, which costs the same as the Codex 3260 V.32bis, also includes a connector for four-wire leased-line operations. The Codex unit we tested supports only two-wire leased lines.

The Codex 3260 V.32bis is about twice the height of most desktop modems. In addition to the usual status lights, the Codex offers a 16-character LCD.

Making setup as easy as possible, the Codex comes with four predefined configurations: for an asynchronous PC, an asynchronous central site, a synchronous terminal for calling to a central site, and a synchronous central site. You can redefine any of these to taste, and restore each of the factory defaults at any time.

As shipped, the Codex modem defaults to the asynchronous PC option settings. It is also set to allow different speeds for the modem-to-modem connection than for modem-to-computer. You may want to change the flow control, since it defaults to XON/XOFF flow control, not RTS/CTS.

The Codex unit has more significant features than we have room to list, including V.25bis command support, a sophisticated security capability, the ability to store nine phone numbers, and the optional V.32bis capability to monitor line quality and initiate a fall back or fall forward in speed. The modem uses a Motorola Codex chip set.

MICC 14410 SA	CXR AJ 9632-MM2	Codex 3260 V.32bis	Hayes Smartmodem 14400	AT&T Comsphere 3810
■	■	■	⌟	■
■	■	■	⌟	■
■	■	■	N/A	■
■	■	■	⌟	■
■	■	■	⌟	■
■	■	■	■	■
■	■	■	■	■
⌟	⌟	■	■	■
⌟	■	■	■	⌟
⌟	⌟	⌟	⌟	⌟
■	⌟	⌟	■	⌟
None	None	None	CompuServe, GEnie	None
2 years Factory	1 year Factory	2 years Factory	2 years Factory	2 years Factory
■	■	■	■	■
■	■	■	■	■
⌟	■	■	⌟	■
■	⌟	⌟	■	⌟

ENDS

FACT FILE

Codex 3260 V.32bis
Motorola Codex, 20 Cabot Blvd., Mansfield, MA 02048-1193; 800-544-0062, 508-261-4000.
List Price: $1,195.
In Short: As you might expect, given Motorola Codex's roots in the data processing market, the Codex 3260 V.32bis has a generous helping of high-end features such as password protection and V.25bis support. Somewhat surprisingly, the Codex also offers good compatibility with popular PC-based software.

CIRCLE 481 ON READER SERVICE CARD

PERFORMANCE TESTS

The first-production V.32bis modems reviewed here **will give you an idea of how the modems you** can buy now will perform. **And when you compare one of these against a** fast 386 with 16550AFN **UART chips and a fast hard disk, the modem** will always be **just a little bit faster. It is likely that your PC, not the modem,** will be **the bottleneck.**

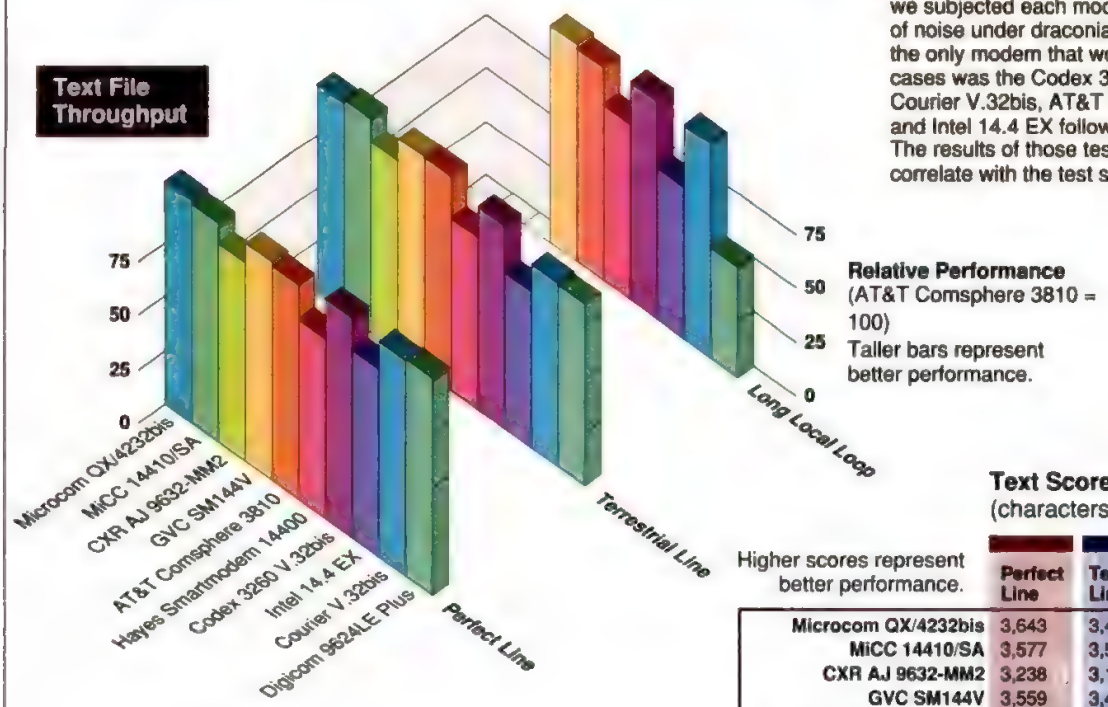
These V.32bis modems are the first ones out of the starting gate. As with most leading-edge products early in their cycle, some problems have not had time to surface, let alone be fixed. But from what we could determine on our tests, we have a good feel for how the models now shipping will work—despite the possibility that some of the vendors will have upgraded their products by the time you read this.

Some difficulties are inherent in the ground-breaking nature of these products. It also does not help the vendors that the modem industry had just settled on the proper way to test echo-canceling modems like these as we began our tests. The prior specification, the Electronics Industries Association/Telecommunications Industries Association's EIA/TIA-496-A standard, serves well for band-splitting modems (such as the ubiquitous 2,400-bit-per-second modem) and for half-duplex synchronous modems commonly used in micro-to-mainframe applications. EIA/TIA Telecommunications Systems Bulletin 37, finally released in January, fills the hole in the description of how to test the new speed demons. The new procedure lets the modem vendors test more in the labs and less in the field; unfortunately, there was no time for them to do any testing before we did.

The first surprise was that there was no way to make two 33-MHz 386 systems transfer files error-free at full modem speed. Some disk controllers (following a design that dates back to XT days) contain ROM-based code that waits for certain events in the controller to happen without using interrupts. The problem is that the software turns off the 80x86 interrupts while it is waiting. At 2,400 bps—4 milliseconds between characters—this does not hurt you. But when you are trying to transfer data at 20 times this rate, your chances of losing data rise from once in a blue moon to a sure bet. Communications software developers quickly found out about this, and the fix they chose was to tell the modem to stop sending data to the computer while the communications program writes data to disk. That 20- to 30-millisecond pause drives down throughput, but it is better than losing data.

The next surprise was just how hard it is to set these modems up properly using the documentation provided. Some of the vendors even had problems giving us setup strings that met our criteria. The moral here is to be careful if you need maximum performance.

In our informal preliminary tests, where we subjected each modem to harsh levels of noise under draconian line conditions, the only modem that worked well in all cases was the Codex 3260 V.32bis; the Courier V.32bis, AT&T Comsphere 3810, and Intel 14.4 EX followed right behind. The results of those tests, in fact, strongly correlate with the test scores we publish.



Relative Performance
(AT&T Comsphere 3810 = 100)
Taller bars represent better performance.

Text Scores
(characters per second)

Higher scores represent better performance.

	Perfect Line	Terrestrial Line	Long Local Loop
Microcom QX/4232bis	3,643	3,449	N/A
MiCC 14410/SA	3,577	3,504	N/A
CXR AJ 9632-MM2	3,238	3,119	N/A
GVC SM144V	3,559	3,497	3,567
AT&T Comsphere 3810	3,500	3,494	3,500
Hayes Smartmodem 14400	2,934	2,801	2,888
Codex 3260 V.32bis	3,581	3,313	3,584
Intel 14.4 EX	3,081	2,538	2,483
Courier V.32bis	3,530	2,988	3,514
Digicom 9624LE Plus	3,555	2,950	1,783

Product order is determined by performance on the Terrestrial Line segment of the Compressed File Throughput test.

N/A—Not applicable: The product did not complete this test.

"Users have got to love the plug and play of the new DEC products; the fact that users can set up the systems in about 30 seconds is great and the products should sell well on that basis alone."

—Doug Gold, director of communications research at International Data Corporation, as quoted in LAN TIMES, April 15, 1991

uct. DEC has used its miniaturization and packaging engineering talents to, in effect, create the industry benchmark example for the right way to design a complex communication product acceptable for use in an exposed commercial workplace as well as a telephone closet . . ."

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Industrial Design Excellence Award GOLD 1991

—Business Week/Industrial Designers Society of America Awards, June 17, 1991

"It is my belief that the DEChub™ 90 product is one of the finest examples of the use of state-of-the-art 'siliconization' techniques to implement a multi-function communication connectivity product.

—Frank Dzubeck, president, Communications Network Architects, Inc., October, 1991

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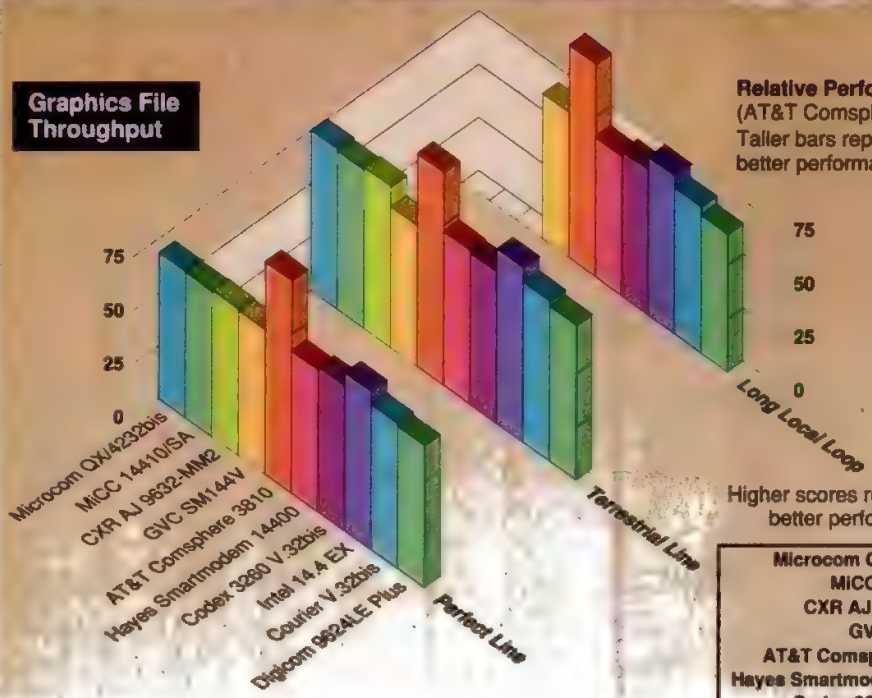
PERFORMANCE TESTS

Graphics File Throughput



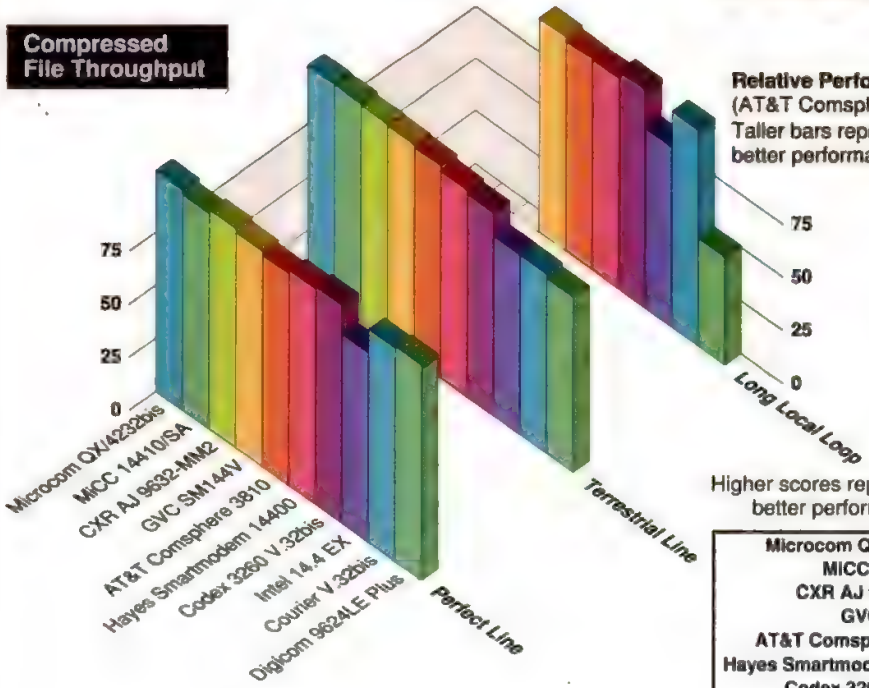
Test Scores
(characters per second)

Higher scores represent better performance.

	Perfect Line	Terrestrial Line	Long Local Loop
Microcom QX/4232bis	3,828	3,825	N/A
MICC 14410/SA	3,807	3,775	N/A
CXR AJ 9632-MM2	3,835	3,830	N/A
GVC SM144V	3,796	3,338	3,826
AT&T Comsphere 3810	5,573	5,081	5,606
Hayes Smartmodem 14400	3,735	3,658	3,670
Codex 3260 V.32bis	3,831	3,616	3,829
Intel 14.4 EX	4,172	4,166	4,166
Courier V.32bis	3,833	3,831	3,834
Digicom 9624LE Plus	3,749	3,708	3,613

N/A—Not applicable: The product did not complete this test.

Compressed File Throughput



Test Scores
(characters per second)

Higher scores represent better performance.

	Perfect Line	Terrestrial Line	Long Local Loop
Microcom QX/4232bis	1,730	1,708	N/A
MICC 14410/SA	1,694	1,701	N/A
CXR AJ 9632-MM2	1,720	1,682	N/A
GVC SM144V	1,691	1,672	1,691
AT&T Comsphere 3810	1,665	1,660	1,664
Hayes Smartmodem 14400	1,693	1,619	1,653
Codex 3260 V.32bis	1,718	1,593	1,713
Intel 14.4 EX	1,492	1,409	1,409
Courier V.32bis	1,678	1,405	1,690
Digicom 9624LE Plus	1,691	1,373	846

N/A—Not applicable: The product did not complete this test.

WHAT THE NUMBERS MEAN

Several elements in a modem work together to define how fast data can be pushed through: the data pump, the V.42/V.42bis firmware, and the power of the CPU chip used in the modem. Many of the modems we tested were not capable of communicating with a PC at 57,600 bps because the code and chips together could not run that fast. (As we went to press, several of the vendors were showing modems that could.)

The Comsphere and Intel were the only products that could handle 57,600 bps. The Comsphere proved to have the edge in our TIFF transfer.

Several modems fell down on one or both of the long-distance line tests. When transferring the text and compressed files, however, no modem stood out above the pack. We expect that as these vendors begin to use the test equipment now on the market they will be able to improve their modems' performance over adverse connections.

HOW WE TESTED

For our test-bed (developed through the efforts of ZD Labs and industry consultant Steve Satchell of Satchell Evaluations), we used *Professional YAM* 17.89 and ZD Labs' own *GETZ* program, both running on Compaq Deskpro 386/33L computers. We had *Professional YAM* send the files using Zmodem, and *GETZ* received the Zmodem transfers and timed them. We elected to write our own program to avoid any slowdowns from either of two causes: communications programs practicing *safe disk* (blocking the reception of data during disk transfers) or disk controllers causing the serial ports to lose data.

Our telephone simulator consists of a Processing Telecomm Technologies (PTT) 5101 Central Office Simulator modified by PTT to conform to the needs of the new specification, two PTT 5151 Impairment Simulators wired in bidirectional-impairment mode, and a 5200 Cable Simulator with local-loop simulator cards installed. A Hewlett-Packard 4947A Transmission Impairment Measurement Set (TIMS) ensured that the simulator was working as expected throughout the test series.

The number 3 figured prominently in our modem throughput tests: We sent each of three files three times through three different simulated telephone lines. Our three files are a text file captured from Ziff-Davis's CD-ROM *Computer Library*, a version of that file compressed using PKZIP.0, and a TIFF file of a line drawing.

In the **Text File Throughput test**, we send a text file roughly 1MB in size across the three simulated telephone lines. Our so-called "perfect" connection is what you might expect when calling from San Francisco to Salt Lake City over digital facilities. Our "terrestrial" connection simulates a city-to-city coast-to-coast connection over older transmission circuits, with defects you would see in one call out of ten. Our "long local loop" simulates a rural- or exurban-to-city coast-to-coast connection over older transmission circuits, with defects you would see in four calls out of ten.

The **Graphics File Throughput** test uses a TIFF file roughly 1MB in size across the same three lines used in the Text File test.

The **Compressed File Throughput** test uses a compressed text file roughly 340K in size across the same three lines.

Before testing each modem at ZD Labs, we determined what the modem setup should be. We then sent our ideas to each vendor for verification. After vendors returned their own recommendations to us, we set the modems and then checked to see whether we could get maximum throughput without data errors before subjecting the products to our severe tests.

Our tables report the throughput in raw characters per second, which means that we include all protocol overhead required to send the data (header, data link escape, and CRC characters). The values shown in the table do not include Zmodem's overhead for sending directory information for each file. We monitored the throughput from the first request for data to the time *GETZ* received the EOF (end of file) signal. The number displayed is a geometric mean of three trials (a geometric mean prevents wild data points from disproportionately impacting the results).

Some programs report only raw throughput, while other programs report the number of characters per second actually written to the file. Since we are testing modems, we elected to look at what the modem sees. Overhead for Zmodem is typically less than 1.5 percent of the total transmission.

An electronic copy of the complete description of our testing procedure is available on PC MagNet. For test equipment information, call Processing Telecomm Technologies at 205-837-7880.

The Codex 3260 V.32bis offers an impressive combination of features, options and price.

The Codex modem was among the leading modems on our tests. Within the range of the modems from AT&T Paradyne and GVC Technologies, the Codex unit held to over 3,500 character per second when sending text files over the perfect and long local loop lines, but slid slightly to under 3,400 cps on the terrestrial line test. Along with the GVC and Hayes modems, the Codex unit moved .ZIP data files at around 1,600 cps or greater under all line conditions.

All told, the Codex 3260 V.32bis offers an impressive combination of features, options, and price. If you do not need the special-purpose features, you can certainly find a less expensive modem. But it is hard to think of any features you may need that the Codex 3260 V.32bis, or 326*x* series, does not offer.

U.S. ROBOTICS INC.

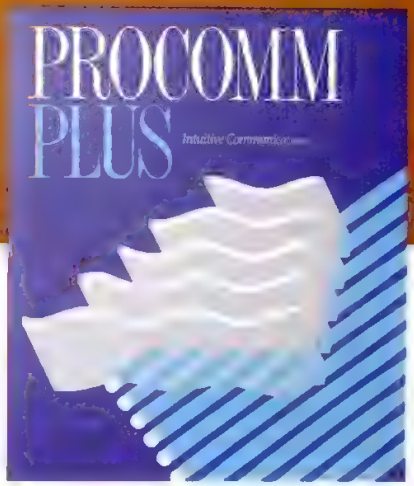
Courier V.32bis

by M. David Stone

U.S. Robotics has long been a strong player in the PC modem market, selling high-quality modems at midrange prices. The $995 Courier V.32bis, built around a U.S. Robotics chip set, fits nicely with the company's track record. You won't find specialized capabilities such as security features, but you will find all you need for general-purpose communications.

The Courier's many convenient features include a list of modem commands on the bottom of the modem and special AT commands to send the list to your screen. On the back, a bank of ten easy-to-reach DIP switches allows settings that you cannot make through commands, such as disabling the AT commands to set the modem for dumb mode. Other switches double for AT commands. You even get a booklet of recommended DIP switch settings for 35 communications programs.

Out of the prairie comes proof that a higher level of communication has arrived.



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CIRCLE 083 ON READER SERVICE CARD

DATASTORM

DATASTORM TECHNOLOGIES, INC.

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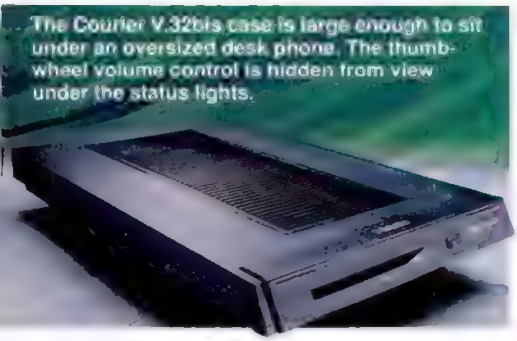
On the front of the modem, you will find a voice/data switch and an especially welcome, easy-to-reach volume control. Unlike software-based volume control, you can adjust this volume control even while the modem noisily negotiates a link.



The Courier V.32bis case is large enough to sit under an oversized desk phone. The thumbwheel volume control is hidden from view under the status lights.

A DOZEN LIGHTS

The 1.6- by 8.3- by 12.7-inch (HWD) case is large enough to sit under an oversize desk phone. It holds a bank of 12 status lights without seeming overcrowded, so you can quickly determine which lights are on.

In addition to the usual status lights, the Courier unit adds lights to indicate a synchronous connection, an error-control connection, and the status of the RTS and CTS lines. The lights do not provide an indication of data compression, error-control type, or speed. (The high-speed light comes on for all connections of more than 2,400 bits per second.) You can set the modem to report on these on-screen, but not all programs will let you see the information.

As shipped, the Courier modem will automatically negotiate the highest possible speed and level of data compression and error control, and will fall back on each feature if necessary. You will probably want to change the default data rate setting to allow different speeds between modem and computer than between modem and modem, and you will probably want to enable RTS/CTS flow control. In addition to its one set of factory defaults, the modem will let you store one user-defined profile.

The real strength of the U.S. Robotics modem is in general-purpose communications.

Software compatibility is good. Not only is the U.S. Robotics brand likely to be supported directly in most communications programs, but on our tests the modem worked with most programs when installed as a Hayes Smartmodem 2400. It had some problems with *Smartcom II* and early versions of *Smartcom III*, but so did the Hayes V-series Ultra Smartmodem 14400.

On our performance tests, the Courier modem ran in the range of the AT&T Comsphere 3810, the Codex 3260 V.32bis, and the GVC SM144V in the transmission of .TXT files; the Courier faltered to about 3,000 cps only under terrestrial line conditions. The Courier unit performed admirably (over 1,600 cps) when moving compressed files under perfect conditions and the difficult conditions of a long local loop, but it slowed to about 1,400 cps on the simulated terrestrial line.

The modem takes advantage of the optional V.32bis capability to automatically initiate a fall back or fall forward in speed as line conditions change. It also provides a feature called Adaptive Speed Leveling, or ASL, which works only with other Courier high-speed modems, dropping speed only in the direction that is affected by a line impairment.

U.S. Robotics includes a two-year warranty. The Courier V.32bis offers some concessions to special-purpose needs, including a leased-line mode that automatically reconnects over a two-wire leased line if it is disconnected. But the real strength of this modem, and the use for which it is easily recommended, is for general-purpose asynchronous communications. ■

FACT FILE

Courier V.32bis
U.S. Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076; 800-342-5877, 708-982-5010.
List Price: $995
In Short: In most ways, the Courier V.32bis is a vanilla modem, without any special-purpose or high-end features. But the Courier is strong on convenience, with touches such as an easily adjustable volume control and a voice-data switch on the front of the modem. It also takes advantage of the V.32bis optional fall-forward capability.

CIRCLE 482 ON READER SERVICE CARD

The Original
V.32bis and Fax Modem

The Original
That's right, Digicom Systems, Inc. was the first modem manufacturer to introduce V.32bis and CCITT Group 3 send and receive fax capabilities in the same modem.

High Speed
The 9624LE Plus operates at 14,400 bps true full duplex, which is 50% faster than V.32 modems and 6 times faster than 2400 bps modems. Effective throughputs of 38,400 bps can be achieved when you add V.42bis data compression. The 9624LE Plus also supports V.42 error correction and MNP levels 2 through 5, allowing you to transmit error-free data.

Crisp and Clean Fax
The 9624LE Plus has Group 3 send and receive fax at 9600 bps. Easy-to-use fax software allows you to send crisp and clean faxes directly from your PC, which means you'll never have to wait in line at the fax machine again.

DSI

Digicom Systems, Inc.
188 Topaz Street
Milpitas, CA 95035-5429

1-800-833-8900

MNP is a registered trademark of Microcom, Inc.

CIRCLE 188 ON READER SERVICE CARD

What has vibrant colors, stunning lines, seamless movement, superb design, a great attitude, command performance, a real flair for speed and won Editors' Choice?

Bravo! The reviews are in for the VRAM II—the top-performing VGA card that makes all your Windows applications run their best. The Editors of PC Magazine write: "The VRAM II really lit up the monitor's phosphors ... when it ran in Super VGA mode with 256 colors and a 72-Hz vertical refresh rate ... In short: A Super VGA adapter with the ability to burn rubber..." And wait 'till you see how the VRAM II dazzles at 1024 x 768 resolution. Get a VRAM II and experience for yourself the VGA card the editors hail as "the one to beat."

PC MAGAZINE EDITORS' CHOICE
September 24 1991
Video Seven VRAM

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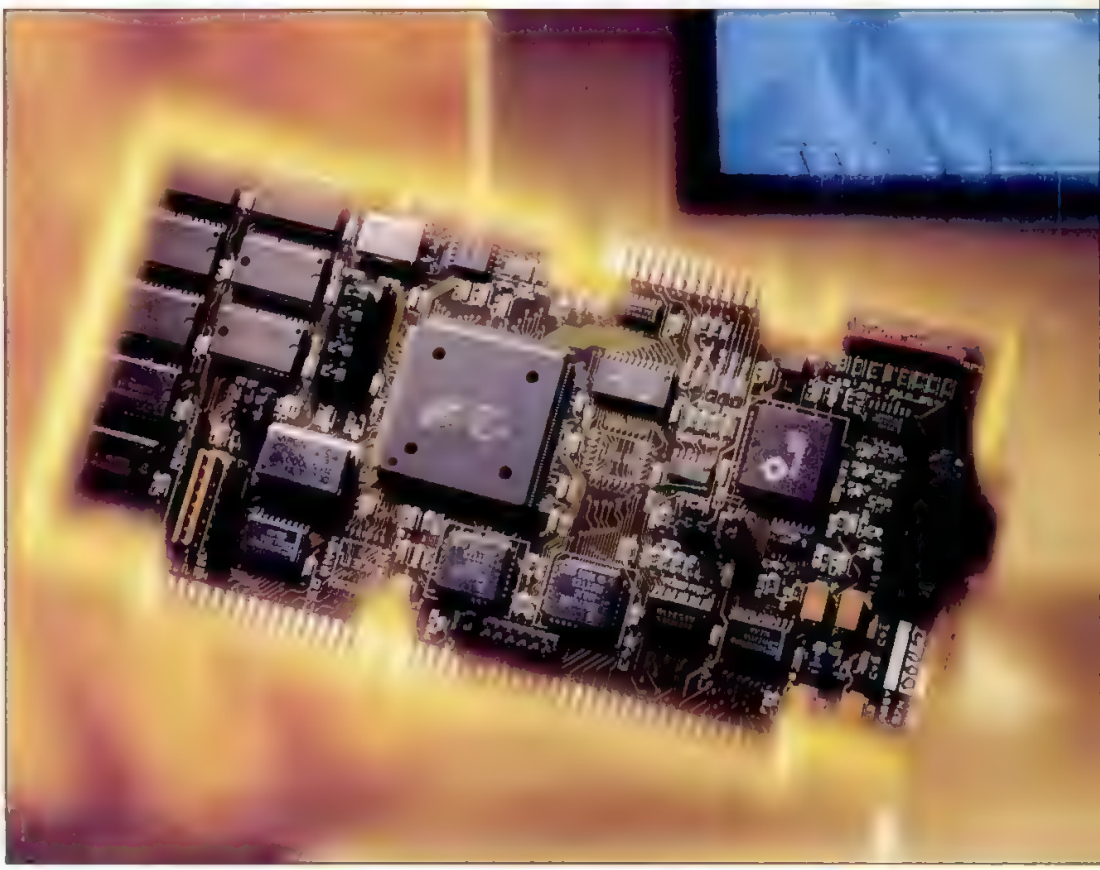
CIRCLE 149 ON READER SERVICE CARD

Graphics Accelerators:



PHOTOGRAPHY TONY CORDOZA

Maybe you don't need a faster PC. Accelerated video cards can improve Windows speed tenfold over standard VGA cards. These 13 affordable graphics accelerator cards can also challenge higher-end, higher-priced coprocessed boards.

Pump Up the Power

by Alfred Poor

One sure way to improve your PC's performance under Microsoft Windows is to invest in a faster video card. The good news is that you don't have to go bankrupt to do it. Accelerated video cards selling for under $500 join the ranks of faster, lower-cost components that make it economical for any user to optimize Windows performance.

Video adapter performance speed is one of the most important hardware issues for Windows configurations. The latest solutions for speeding up video performance come from accelerated video adapters, a category that has garnered a lot of attention

recently in the press and among computer users. In this issue, we look at 13 graphics accelerators from Actix, Artist, ATI, CSS, Diamond, Genoa, Glad, Hornet, Orchid, Pixel, Portacom, and STB. These products are designed to give you the best combination of resolution, color, and performance at a very affordable price. They're far faster and a bit more expensive than vanilla VGA or Super VGA video cards known as dumb frame buffers ("Super VGA Boards: Fast Enough for Windows, Cheap Enough For You," *PC Magazine*, September 24, 1991), and can perform as well as or even better than coprocessed video cards based on the TI 34020 chip ("1,024-by-768 Coprocessed Graphics Adapters: High Resolution and High Speed", *PC Magazine*, June 25, 1991). If it's bang for the buck that you want, these video accelerators are the cards to buy.

The difference between Windows with an accelerated video adapter compared with a typical VGA or Super VGA adapter is striking! As you'll see in the Windows Benchmark Test results, improvements by a factor of 5 or 10 are not uncommon under Windows. That's like taking a 20-MHz 386 and speeding it up to 100 or 200 MHz. On-screen, you can really see the difference.

WHY THE NEED FOR BETTER VIDEO?

Only a few years ago, when we spent most of our time in text-based DOS applications, 16 colors of text on a display powered by a standard VGA adapter was more than sufficient. Sure, most developers wrote directly to the hardware to get some extra speed, but that was more a matter of the video BIOS's ROM chips being slow than any inherent speed problem with VGA cards.

For many reasons, it was the overwhelming popularity of Windows 3.0 that really increased our expectations of what we needed from a video adapter. One reason is that Windows itself requires a great deal of system and CPU resources merely to operate effectively and efficiently. In fact, you might even say that Windows is piggish. Most accelerator boards help out these beleaguered CPUs by off-loading certain, most-often-performed graphics operations—such as bitblts (bit-block transfers), line draws, or image processing—from the system CPU to the accelerated video chip, thereby freeing the CPU to better concentrate on other tasks. Another accelerator approach, taken by Chips and Technologies in its 82C453 chip, involves decreasing the number of bus cycles the CPU must perform for certain graphics operations in order to increase performance.

Within the Windows graphics environment, we want to see more than just 16 colors. With more colors, scanned color images look more realistic, and gradients lose their dithered bands to become soothingly smooth backdrops for computer tasks. Of course, having more colors on-screen can take its toll on video performance with standard dumb frame buffer cards. (In general, with any video card, you also need more on-board memory, typically 1MB for 256-color mode.) Each pixel on a display's image represents information; more pixels on the screen mean more information is required. If you want to be able to choose from a larger number of colors for a pixel, then more information is required for that pixel and for all other pixels on the screen.

A standard VGA display operating at 640-by-480 resolution is made up of about 300,000 dots. One bit of information can only tell a dot to turn on or off. Four bits yield 16 colors. The result? A standard 640-by-480 VGA screen requires about 1,200,000 bits of information (300,000 * 4) or about 150K. Increasing to 256 colors doubles the number of bits required, and thus doubles the information requirements to about 300K per screen. That's a lot of information to be moving through the display adapter. It gets worse: By the time you get to 1,024 by 768 by 256 colors, the load increases to almost 800K. All this adds up to decreased performance when using a dumb frame buffer to display 256 colors, even in 800-by-600 mode. With video accelerator cards, that's less of a problem. Our weighted summary indexes of Windows performance for the accelerator boards generally showed little difference between their 16- and 256-color scores.

Operating at higher resolutions also holds appeal for Windows users. Higher resolution means more dots on the screen, and that results in the ability to either display more information at one time, or to sharpen the image of the same information that was available with only a "coarse" VGA screen. Upping the reso-

HIGHLIGHTS: Video Accelerators

- Accelerated video cards can provide Windows performance that is five to ten times as fast as standard dumb frame buffer cards. You'll also see an increase in the performance of your CAD programs, because many of the graphics functions most video accelerators speed up are also used in these packages.

- Video accelerators based on the S3 86C911, Weitek W5086, Chips and Technologies 82C453, or IIT's UV6000 chip typically cost under $500 with 1MB of RAM; that's about half the cost of a coprocessed card. ATI's products, using the company's Mach 8 chip, are more costly, but offer the advantage of extra features such as Crystal Fonts.

- Unlike coprocessed cards, which are fully programmable, most of the video accelerators are fixed-function processors. That is, they build in the functionality for specific graphics functions such as bit-block transfers, line draws, and area fills; in doing so, they off-load some of the processing burden from the CPU. Those accelerators that rely on the Chips and Technologies chip take a different approach, relying on decreasing the bus cycles the CPU must perform to process these graphics functions.

- Accelerator cards *can* compete with their higher-priced, coprocessed competition. On our Windows benchmark tests, for example, many of the accelerated cards provided better performance indexes than did a coprocessed board used for comparison.

- Fast hardware in and of itself does not always equal optimum Windows or *AutoCAD* performance. Drivers are a key factor, as evidenced by the fact that some products that did very well on our VGA Performance Tests did not live up to that mark on our Windows and *AutoCAD* tests. ■

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Performance							
Features and flexibility	(175)	Satisfactory	Good	Very Good	Excellent	Very Good	Very Good
Rescheduling/resource leveling	(100)	Satisfactory	Satisfactory	Good	Excellent	Very Good	Very Good
Speed	(75)	Satisfactory	Very Good	Excellent	Very Good	Very Good	Satisfactory
Reporting	(100)	Good	Good	Good	Very Good	Very Good	Very Good
Documentation	(75)	Very Good	Good	Very Good	Very Good	Good	Very Good
Ease of learning	(100)	Very Good	Very Good	Very Good	Very Good	Good	Very Good
Ease of use	(125)	Good	Good	Very Good	Excellent	Good	Good
Error handling	(75)	Good	Good	Satisfactory	Very Good	Good	Very Good
Support							
Support policies	(50)	Good	Good	Very Good	Good	Good	Very Good
Technical support	(50)	Very Good	Very Good	Satisfactory	Excellent	Satisfactory	Very Good
Value	(75)	Satisfactory	Good	Very Good	Excellent	Very Good	Very Good
Final scores		**6.0**	**6.4**	**7.1**	**8.7**	**6.8**	**7.1**

Source: *InfoWorld*, November 26, 1990

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lution will, however, have an effect on performance. Informal tests conducted by PC Magazine Labs show that a Super VGA board run at 800 by 600 by 256 colors is about 10 percent as slow as when run at 640 by 480 by 256. You should expect to find similar degradation when running at 1,024-by-768 or 1,280-by-1,024 resolutions with these boards. And that's why you should consider accelerated (or coprocessed) video cards: They increase performance several times over by taking on some of the more common graphics functions that your CPU would otherwise have to perform.

DEFINING THE VIDEO TYPES

To be more specific, video accelerators do not remove the CPU from the picture entirely. Rather, most of the accelerator chips (except for the 82C453) accept the specific graphics functions from the CPU, which are then translated into image information within the display adapter itself. This speeds up the entire process in two ways: The CPU does not have to spend as much time creating the entire image, and the condensed commands take less time to transmit to the adapter than the full image would. The commands to which these accelerators respond are limited in scope and cannot be modified or built on; unlike coprocessed cards, they cannot accept programmed instructions. These accelerators are frequently referred to as *fixed-function processors*.

The Chips and Technologies accelerator chip, featured in the Artist Graphics WinSprint 100 reviewed here, marches to its own drummer. Rather than being a fixed-function accelerator, it relies on a technique called single-cycle read-modify-write operation. The host CPU is still directly involved in processing bitblting,

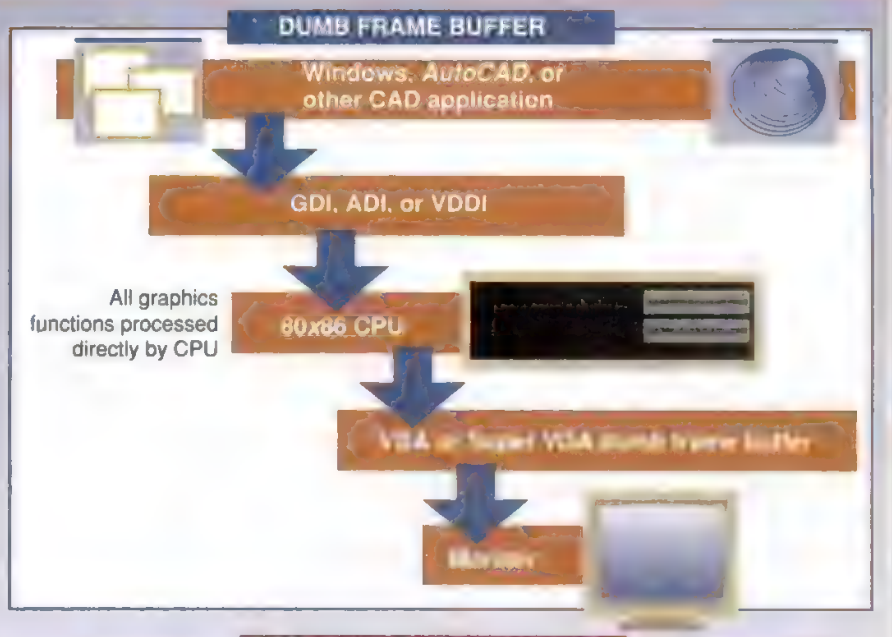
HOW GRAPHICS ACCELERATORS IMPROVE PERFORMANCE

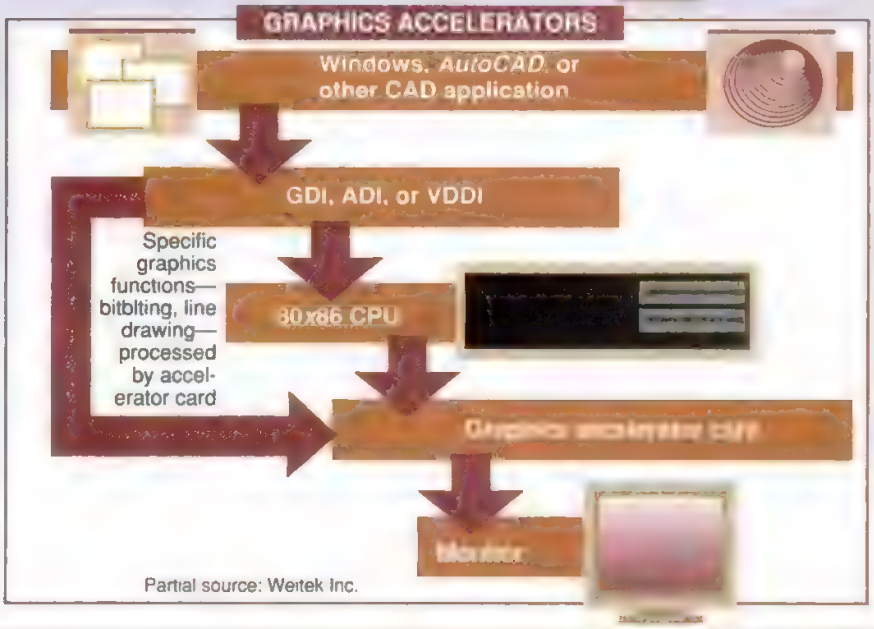
Graphics accelerator chips such as those from ATI, GSI, S3, and Weitek achieve their speed increases by off-loading specific graphics operations from the host CPU. Among the graphics functions hard-coded into most of these chips are those for bitblting, line drawing, area filling, image transfers, and raster operations. The S3 chip also offers hardware cursor support.

On a vanilla VGA or Super VGA system, functions such as these are processed directly by the CPU from start to finish; with these dumb frame buffers, the CPU exits the process only after sending the information to the adapter, where the data is held in a buffer before it is sent out to the display as an analog signal. The accelerator chips found in the boards reviewed here (with the exception of the Chips and Technologies chip in the Artist Graphics board) free the CPU from the task of actually processing these functions.

Bypassing the CPU in these instances increases the on-screen performance of applications. Many of these specific graphics functions are part of the Windows GDI (Graphics Device Interface), *AutoCAD*'s ADI (Autodesk Device Interface), or other CAD programs' VDDI (Video Display Driver Interface). All these chips enhance the performance of Windows applications and help the speed of many non-Windows-based applications, such as *AutoCAD* and other CAD programs. Weitek doesn't specifically claim to increase the performance of CAD applications, but because the board handles line drawing—a dominant function in many CAD programs—there is an effective increase in speed.

The diagrams illustrate the performance-enhancing relationship these chips exhibit when used in a Windows or CAD environment, where many of these products find their greatest appeal.





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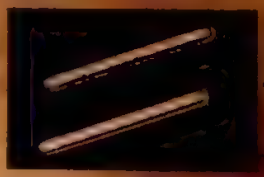

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line drawing, and other graphics functions, but the bus cycles required to accomplish them are reduced from two to one. This results in speedier host-directed bitblts, line draws, and other specific graphics operations.

In the video board arena, video accelerators fall midway between dumb frame buffers and coprocessed boards. Dumb frame buffers refer to most typical VGA adapters, which have relatively little intelligence. Dumb frame buffers require the computer's CPU to figure out what a graphics image should look like; then the CPU sends the information to the adapter, where the data is held in a buffer before sending it out to the display as an analog signal.

Coprocessed adapters are typically based on one of the Texas Instruments 340X0 family of image coprocessors. Coprocessed boards rely on a chip that is more like the computer's CPU than anything else. These chips do not rely on a fixed set of instructions but are programmable. They are generally fast, powerful, and flexible, but tend to be quite expensive, and less attractive to the general market. Boards based on the popular TI 34020 chip today typically sell for close to $1,000 with 1MB of RAM and on-board VGA, and prices for Number Nine's TI 34020 series boards hover at around $1,200 or more, for instance. Currently, prices for similarly configured boards based on the less powerful TI 34010 coprocessor, such as Beaver Computer Corp.'s TIGA-10, can still set you back about $600. Indeed, some of the 34010-based boards can be almost as expensive as their 34020-based competition; the 34010-based NEC MultiSync Graphics Engine Board, for example, sells for $999 in its 256-color version.

There are indications that prices are coming down, though—at least when it

LOCAL BUS VIDEO: The Future of Graphics

The industry thinks 1992 will be the year of local bus video. Of course, a few minor details have to be worked out, like developing real standards and getting products to market.

by Oliver Rist

Most industry analysts agree: Accelerator-chip cards are important today, but local bus video is definitely the future, and not just—or necessarily—for accelerator chips. Super VGA and coprocessed chips will play a big part in the local bus marketplace.

Local bus video is certainly appealing in many respects. Put simply, local bus video is video running at CPU speed. By taking your standard VGA chip set, graphics coprocessor, or graphics accelerator off an 8- to 10-MHz I/O bus and placing it on the motherboard, or in a special EISA slot that allows it to function as if it were on the motherboard, system manufacturers allow your pixels to be managed at the same speed the processor runs (20, 25, 33, or even 50 MHz). Graphics data can be transferred at 32 bits instead of just 8 or 16.

There are a number of ways to accomplish this feat and, as you might guess, they're not all compatible. So VESA (Video Electronics Standards Association) is even now looking at establishing an industry-wide standard. At the time of this writing, VESA had just established the official local bus committee and two direct-focus subcommittees: one to examine local bus video support across multiple platforms and another to look at connector and signal issues. Opinions vary as to when VESA will actually arrive at a workable solution (anywhere from the end of March to the end of September 1992), but the members of the VESA committee—including representatives from Everex, OPTi, Panacea, and an ever-growing number of other PC graphics vendors—all believe that 1992 is the year of local bus.

WHO ELSE?

Some vendors—including a number of VESA committee members—are not waiting for a standard. Rather, they are implementing local bus solutions today that they hope will become (and remain) standards tomorrow. The undisputed leader to market was NEC with its PowerMate SX/20i. Utilizing a Tseng chip set–based solution, the PowerMate did not, however, always fare as well as expected on PC Magazine Labs' tests (reviewed in First Looks, November 12, 1991). PC Labs' Windows tests proved only a 6 to 7 percent increase over an ISA-card Tseng implementation, though the straight VGA tests had speed differences up to 60 percent.

Another local bus system manfacturer, CSS Laboratories, offers the Preferred 433GE (a 33-MHz 486 EISA system with an S3-based MaxGraphics board in a proprietary slot). The $4,255 433GE shipped in November of 1991. And ship-right-now vendor Micronics has come up with its own implementation of local bus, limited to its own motherboards and leaving the video on a special internal EISA slot.

The next local bus product wave will probably be led by Headland Technologies, OPTi Inc., S3, Trident Microsystems, and Tseng Laboratories. Utilizing a core logic chip set developed by OPTi (called the DXBB), Headland (with its local bus video chip, the HT216) and these other video chip manufacturers will be able to put video on your motherboard or in an EISA slot and run at full CPU speed.

Appian Technologies and Western Digital Imaging are both taking a more concentric approach, though they will not have products to market as quickly as some of the competition mentioned above. Both are developing similar technology to OPTi and the others, but they're keeping everything proprietary; each has its own core logic and video combination. Western Digital's VLBI combination will remain a silicon-only product and be available only to system board OEMs. Appian is going one step further by placing its Advanced Graphic 98032 Device on its own

comes to the 34010 boards. Hercules' $495 Graphics Station GOLD, which began shipping after our deadline for inclusion in this roundup, sells for under $500, but that doesn't include on-board VGA. At press time, we also learned that Evershine Technologies International had announced it would ship its 34010-based board, the Ever-10 VGA TIGA Board, with 1MB of VRAM and on-board VGA, for $435 by early this year.

REVIEW CRITERIA

To be included in this review, a product had to fulfill one of the definitions of an accelerator card outlined above; that is, it had to speed up specific graphics operations by hard-coding them into the controller or by using the single-cycle read-modify-write technique.

With the exception of the ATI Graphics Ultra, ATI Graphics Vantage, and Hornet Rapix I, we only looked at accelerator cards that carried a list price below $500 with 1MB of RAM and on-board VGA. We included the more expensive Graphics Ultra and Graphics Vantage because of the great customer interest in the products, and we included the $199 Hornet even though the Weitek W5086 chip it uses is not physically capable of accommodating more than 512K RAM. We only looked at cards for the ISA bus. We required that the cards be compatible with our test-bed of a Compaq Deskpro 386/25e system and a Sony 1304 monitor. We also asked that the companies supply us with 800-by-600 drivers for both Windows and *AutoCAD*, but did not require that they offer those drivers for both 16-color and 256-color modes. Lastly, we required that the company manufacture its own rather than OEM the board. (We considered looking at coprocessed cards that could meet all these filters, including price, but could not find any that filled the bill during our evaluation period.)

Those filters left us with 13 boards, eight of which were based on the new 86C911 chip from S3 (pronounced *S Cubed*). They are: the Actix Graphics-Engine Display Accelerator, CSS Maxgraphics/16, Diamond Stealth VRAM, Genoa WindowsVGA, Orchid Fahrenheit 1280^{p}, Pixel Turbo Windows Accelerator, Portacom Eclipse II, and STB Wind/X. The two ATI boards use ATI's own Mach 8 accelerator. The Hornet Rapix I uses the Weitek W5086 chip, and the Glad UltraView uses a proprietary UV6000 chip manufactured by IIT. The Artist Graphics WinSprint 100 was the only card we saw that uses the Chips and Technologies 82C453 chip. This chip is also found in the $279 Desktop Quick DrawVGA from Desktop Electronics, which we reviewed in the September 24, 1991, issue of *PC Magazine* and did not look at again here. Micron Technology's $319 UltraVRAM Super VGA Graphics Card, which did not ship in time to be included in this review, also features the 82C453 chip. Other companies that use the 82C453 chip in their boards but did not ship in time for this review include Ergon and Monolithic.

It is plain to see that there are only a handful of manufacturers in the accelerated video chip market, the most popular being the chip from S3. The S3 chip, along with ATI and its Mach 8 chip, carries on the legacy of the now defunct IBM 8514 chip. Both the S3 and ATI chips share varying degrees of compatibility with the original 8514 design in terms of some of the graphics primitive commands that are accelerated. But the price tag for the S3 boards, in particular, is less than most current boards that use an 8514-compatible chip. (For example, the Adix 8514/AT 256 and Western Digital 8514/A were

Express Modular Local Bus Architecture product—basically a motherboard containing video and core logic, as well as IDE and SCSI interfaces and missing only a processor and memory. The SCSI interface will use SCSI II while the 98032 device will support VGA resolutions to 1,280 by 1,024, 8- to 24-bit color, and full VESA-refresh compatibility.

LOCAL BUS GUI ACCELERATORS

Will there be local bus graphics accelerators? S3 thinks so and it was actively moving to market its 86C911 accelerator as a local bus product in 1991. (A chief customer is Micronics, whose special-slot local bus product is S3-based.) But other vendors view GUI acceleration as a niche product that wouldn't add as huge a benefit for the increased cost on the motherboard as a less-expensive, fast VGA chip set or especially a high-end graphics coprocessor.

Weitek, another graphics accelerator manufacturer, has decided to play a waiting game. Citing a reluctance to view graphics acceleration as a new generation of video technology rather than just a short-term solution, Weitek is waiting for the VESA local bus standard and will then probably take a more high-end and all-purpose approach.

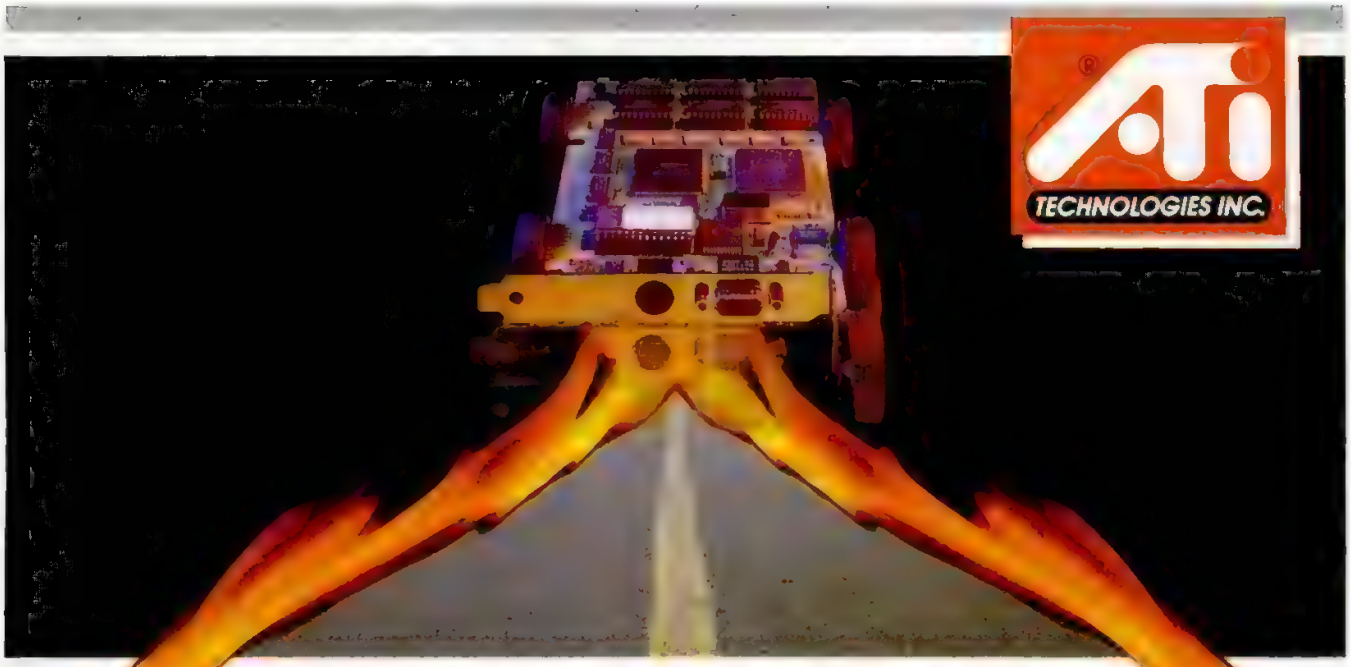
CURRENT COSTS AND LOCAL BUS II

Will straight Super VGA local bus end up costing you more? The answer is probably not.

Headland, for instance, will market its systems to motherboard manufacturers for about $60, which translates to a maximum end-user cost of $199 to $299. Matching that price with 1MB of memory, 1,024-by-768 resolution in 256 colors, 800-by-600 resolution in 32K to 64K colors, full VESA 72-Hz refresh compatibility, and performance increases between at least three and ten times, and the cost-effectiveness of local bus video becomes all too apparent.

There are other related technologies on the horizon as well. Intel and Dell demonstrated the potential capabilities of a new product at 1991 Fall Comdex—essentially a way to allow the central microprocessor, usually a high-end 486—to manage pixels directly using system memory. Though performance increases promise to be dramatic, the partners still classify this product as in the R & D stage, for now.

If local bus is truly as successful as industry analysts believe it will be, what will the second generation bring? Though specific manufacturers did not wish to have their names mentioned yet, multimedia seems as big a buzzword to the local bussers as it is to the average end user. System-board full-motion video and compression chips, sound, and even faster graphics capabilities are all in the works. Buy it in the beginning of 1993 and your next system board could boast more glitz than one of Cher's Academy Award gowns. ■



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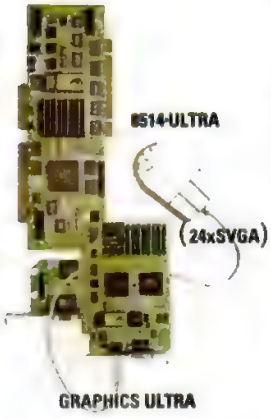

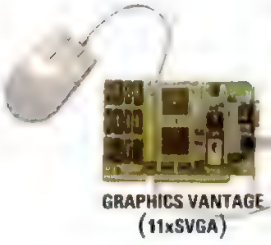

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CIRCLE 337 ON READER SERVICE CARD

priced between $1,200 and $1,300 when we last reviewed them in "High Resolution and High Speed," *PC Magazine*, June 25, 1991.)

Aside from the ATI boards, prices for this line of products range from a nearly VGA price point of $199 for the Weitek-based Hornet board to $499 for the STB Wind/X. Many of the boards boasting price tags in the upper $400 range include a Sierra HiColor RAMDAC chip in the cost, although the STB Wind/X did not.

Many other companies were planning to release boards based on the S3 chip by the time you read this, including Advanced Integration Research, Cache Computers, Elsa America, Fujikama, and Mylex. Weitek's own Weitek Power for Windows, which uses its W5086 chip, was not shipping in time for this review. Boards based on the Weitek chip from Data Expert, TMC Research, and Young Microsystems were also not available in time for testing. Quickpath and Ground-Hog offer OEM versions of the Pixel Turbo Windows Accelerator, and Glad Systems' Glad Flashview was not shipping in time for this review.

We excluded the 1MB-equipped $549 Ultra VGA from Hewlett-Packard and the $649 Matrox Hyper VGA from Matrox because they exceeded the $500 price limit.

WHAT ABOUT REFRESH?

Refresh rates are a factor when it comes to discussing any video board's performance. On any monitor, a CRT (cathode-ray tube) creates an image by playing an electron beam across the inside of a phosphor-coated glass vacuum tube. The phosphor dots glow when hit by the electrons, then start to fade. To maintain the image, the signal must repaint (refresh) the entire screen so that the image appears steady.

If the refresh rate is too slow, the image will appear to jump and flicker. In 1987, when IBM introduced VGA, the VGA boards that followed on its heels—as well as the early Super VGA boards—relied on a 56- or 60-Hz vertical refresh rate (56 or 60 cycles per second). Many users, however, found the resulting flicker to be annoyingly pronounced. VESA (Video Electronics Standards Association), an organization composed of monitor, video board, video chip, and software applications vendors, helped rectify the situation. It implemented a standard calling for a 72-Hz refresh rate in 800-by-600 Super VGA mode, which helps reduce flicker significantly. In 1,024-by-768 mode, the VESA standard specifies a 70-Hz refresh rate; there is no VESA refresh standard for 640-by-480 mode.

There's no real performance hit by increasing the refresh rate, even for a dumb frame buffer Super VGA board. PC Labs conducted informal testing on a standard Super VGA board, the ATI VGA-Wonder XL Plus in 800-by-600 mode at 16 colors, and at 56-, 60-, and 72-Hz refresh rates. We found that on operations that were slower at the highest refresh rate, the difference was only by fractions of a percentage point.

The real problem concerning refresh rates for many of the products using this class of chip is not speed, but compatibility with the VESA standards. Not all the chip manufacturers fully implement the

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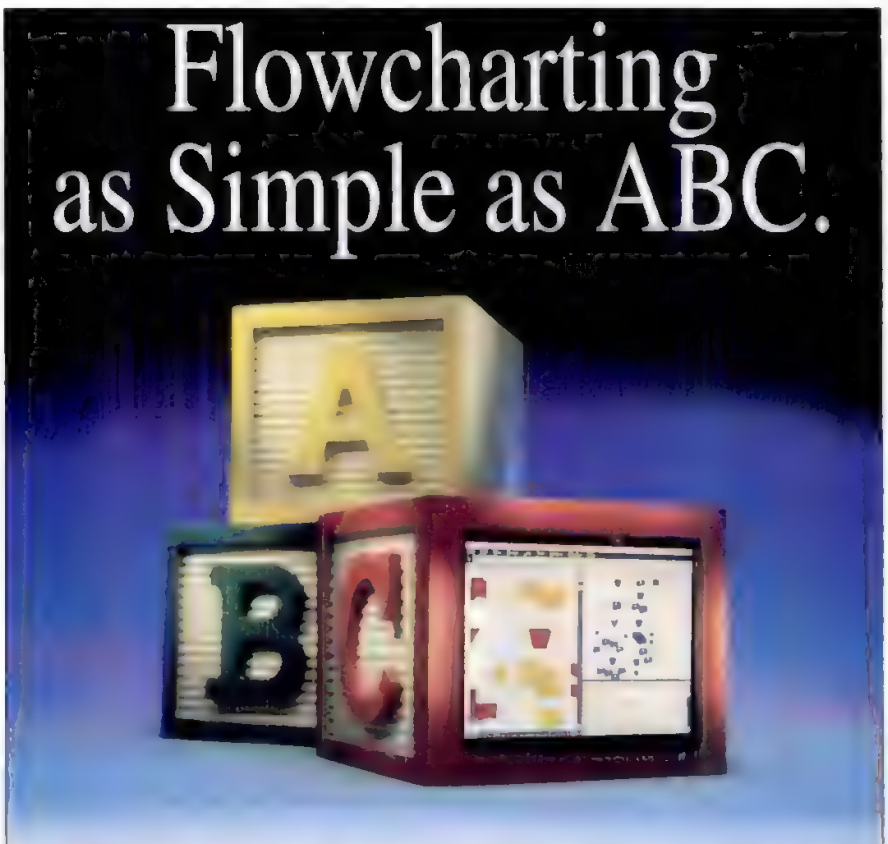

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Sound Blaster
One of the boards we installed in the Arche 486 was Sound Blaster. With its associated software, it has quietly (no pun intended, but what the heck) become the standard sound system for advanced PCs. The Roland board has much higher sound quality for a higher price, but for anything short of professional music quality, Sound Blaster is good enough

There are lots of other accessories you can get for Sound Blaster, including musical instrument software and a voice editor. Sound Blaster has become the standard sound board if not for the industry, at least here at Chaos Manor. Recommended

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SNEAK PEEKS

SOUND BLASTER PRO

In just two years, the Sound Blaster has become one of the the most widely-supported PC sound cards. It's easy to see why. The Sound Blaster contains an 11-voice FM synthesizer that makes it fully compatible with the popular Ad Lib Music Card. The day it hit store shelves, the Sound Blaster could be used with hundreds of Ad Lib compatible games and educational programs. To add even more value, the original Sound Blaster included a DAC (Digital to Analog Converter) for digitized voice and sound effects, a microphone jack for voice input, a built-in game port, a built-in 4-watt amplifier, and an optional MIDI interface.

The built-in mixer makes the Sound Blaster Pro fully compliant with Microsoft's Multimedia Level 1 Extensions to *Windows*. Multimedia software will be able to fade-in, fade-out, and pan the various audio sources to create elaborate sound montages.

The Sound Blaster Pro includes a CD-ROM interface for either an internal or external CD-ROM player.

There's also an internal connector for CD-Audio. The MIDI interface is compatible with the original Sound Blaster's MIDI interface, but adds the MIDI time-stamp that's part of Microsoft's new multimedia standard.

All in all, the Sound Blaster Pro is chock-full of new features, yet it's fully compatible with its younger brother.

DAVID ENGLISH

Scheduled Release: September 1991
For IBM PC and compatibles—$299.95

CREATIVE LABS
2050 Duane Ave
Santa Clara, CA 95054
(408) 986-1461

PC GAMES

SOUND BLASTER PRO

By Barry Brenesal

The Marines may look for a few good men, but any PC game player will gladly settle for a single good sound card: one that plays both Sound Blaster and AdLib scores, one that doesn't fry your other boards, one that never draws attention to itself, one that delivers all the sophisticated sound effects and music bundled into the latest batch of game software.

Look no further: Sound Blaster Pro does it all, and more. At $299.95 it's not cheap, but neither are its features.

Testing: One, Two . . .

Installing Sound Blaster Pro is a snap. The 16-bit card slips easily into place. It comes with

Trying out Sound Blaster Pro is a treat. It's got great frequency response — that's the difference between listening to a film score on a tinny, muffled AM radio and hearing it on a stereo movie-theater speaker system. The orchestral soundtrack to Origin's Wing Commander is a good example, because it changes mood and melody to match the success of your current battle. Add Sound Blaster Pro to a good VGA screen and a responsive joystick (which you can plug into Sound Blaster Pro's joystick port), and the illusion of dogfighting aliens in a George Lucas-style film becomes 3-D, symphonic reality.

Another plus is the absence of the annoying background hiss

In short, Creative Labs' Sound Blaster Pro is a big winner. It's quick to install, easy to use, full-featured, and compatible with Sound Blaster and AdLib files. Signal response is excellent. And don't forget

PC HOME JOURNAL

SOUND BLASTER DOES IT ALL

Review by Harvey Bernstein

The Sound Blaster has so many audio applications packed into one half-sized board that it almost boggles the mind. First, it has an 11-voice stereo music synthesizer that is fully compatible with the widely used AdLib sound format. Older software that only supports the AdLib board will automatically turn on the AdLib mode — no adjustment by the user is necessary. A separate channel is exclusively for reproducing digitized speech. A microphone jack on the back of the card allows you to digitize your own input voices. With a 4-watt stereo amplifier built in, you can run speakers or headphones directly from the card — no additional amplification is necessary. A standard joystick port also doubles as a MIDI interface, allowing you to connect a synthesizer or any other MIDI instrument. Combine this with an excellent library of software, and it is easy to see why the Sound Blaster has become so popular.

The Sound Bl... Is the Sound Blaster worth the investment? Yes, yes, a thousand times yes!!! When you hear how much the Sound Blaster increases the capabilities of your PC, you'll wonder how you ever got along without one.

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So before you get into multimedia, call 1-800-544-6146 or see your dealer. You'll like what you hear.

CREATIVE LABS SOUND BLASTER PRO

Creative Labs, Inc., 2050 Duane Ave., Santa Clara, CA 95054 Telephone: (408) 986-1461 Fax: (408) 986-1777 For international information, fax Creative Technology at (65) 773 0353. Sound Blaster is a registered trademark of Creative Labs, Inc. Windows and Bookshelf are registered trademarks of Microsoft Corporation.

CIRCLE 086 ON READER SERVICE CARD

VESA VBE (Video BIOS Extensions) standard. The VBE standard refers to the chip's integration of VESA modes into its ROM BIOS. The S3 chip, for instance, is capable of supporting VBE in ROM BIOS, but a bug in the BIOS of versions of the chip through 1.6 (used by every S3 company represented here) kept it from automatically being able to implement VBE compatibility fully. The S3 board vendors by and large had to supply proprietary drivers to access VESA-compliant refresh rates. The C & T and Weitek chips support the VESA modes in BIOS, but the UV6000 and Mach 8 chips do not.

S3 also fell short in providing its vendors with drivers for the Sierra HiColor RAMDAC chip. Though many of the boards can accommodate the Sierra RAMDAC—and indeed several companies sent review units prominently featuring the chip—S3 was unable to provide its customers with drivers, so we could not test this feature. The current version of the S3 chip also cannot support 1,280-by-1,024 mode in Windows, although it can under *AutoCAD*. The company does not support that resolution for Windows because it can't support a hardware cursor. Vendors using the chip can support that resolution under Windows by implementing a software cursor.

PERFORMANCE QUESTIONS

In order to provide a low-end and high-end reference point, we ran our benchmark and performance tests on both the $399 ATI VGAWonder XL Plus (a former Editors' Choice) and the $1,995 TI 34020–based coprocessed board from Number Nine, a well-known vendor in the industry.

As we've noted, accelerator cards offer clear performance gains over dumb VGA frame buffer designs; they are as much as 5 to 10 times as fast. If that's not enough to convince you to upgrade, though, there are a number of tricks you can do to improve the performance of your standard VGA or Super VGA card (see the sidebar "Making Windows Fly"). One of the things you might try are the *WinSpeed* drivers from Panacea; our Windows tests show that it doubled the performance of the ATI VGAWonder XL Plus when run with its own drivers.

You might think that, given the added advantages of a coprocessed board, accelerators would always trail behind them. But on our Windows Benchmark Tests, the Number Nine 9GXi Graphix Coprocessor board did not outshine the accelerator-based products. In fact, its performance index scores fared in the midrange on most of our Windows tests—not only that, but its performance index on our Windows 16-color Text-Intensive Applications tests was close to the poorest we saw. (The Number Nine board did gain some very high scores on individual benchmark tests; its average or low Windows performance indexes are the result of its not having achieved those high scores in some of the more heavily weighted Windows tests.) And on our *AutoCAD* tests, it provided top performance in only one category.

Among the accelerators themselves, we observed that fast performance on our VGA tests does not always translate into optimum performance on our Windows

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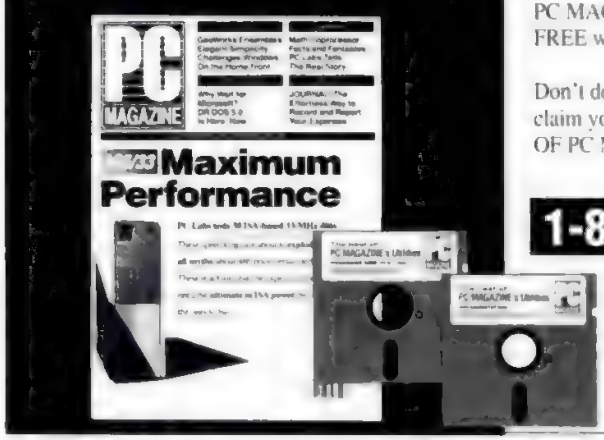

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tests. For instance, both the Hornet Rapix I and the Artist Graphics WinSprint 100 exhibited strong performances on our VGA tests, but neither proved a leader on any of the Windows performance indexes. On our Windows 16-color tests, S3-based boards from Diamond, Genoa, and Portacom took the leading positions. The ATI Graphics Ultra took top honors on the Graphics-Intensive Applications 256-color Windows test, but was closely followed by the exemplary Diamond board.

Accelerator boards boost more than just Windows performance. On our *AutoCAD* tests, the accelerated chips easily bested the ATI VGAWonder XL Plus and often came out ahead of the Number Nine board. The accelerator boards' fine performance on these tests isn't too surprising, since many of the graphics functions built into the accelerators are used as much in *AutoCAD* as they are in Windows.

One other finding worthy of note is that changing the speed of the CPU can significantly affect the performance of the video board. PC Labs conducted informal tests in which we placed an accelerator card in three different 386-based computers—one running at 20 MHz, one at 25 MHz, and one at 33 MHz. We tested it at 800-by-600 resolution in both 16- and 256-color modes. The results show that CPU speed has an enormous effect on performance. On many of the tests, the improvements ranged from 20 percent to more than 100 percent as you go from one clock speed to the next highest.

LOCAL BUS

Accelerated video boards certainly boost performance, but some computer manufacturers are also trying out new ways to increase speed. Some vendors are building display adapters into the motherboard (or sometimes into a special slot on EISA machines) so that they can be addressed directly by the CPU without having to go through the expansion bus. (See the sidebar "Local Bus Video: The Future of Graphics.")

The ISA bus dates back to the original IBM PC AT and is run at the solemn pace of just 8 MHz on most computers—no matter how fast the CPU might be running—because some expansion cards cannot handle faster speeds. The EISA bus runs at only 8.5 MHz. While it is true that many motherboard designs have the

PC MAGAZINE EDITORS' CHOICE

- **Diamond Stealth VRAM**
- **Portacom Eclipse II**

Among the 13 video cards reviewed here, excellent prices and high performance translate into winning votes for the $445 Diamond Stealth VRAM and $325 Portacom Eclipse II. Although they use the same S3 chip as six other boards in this review, the Stealth VRAM and Eclipse II manage to distinguish themselves from the competition.

These two boards have the advantage of well-designed hardware to complement the high ratings they achieved on our Windows performance index, where good scores generally result from well-written drivers run on sturdy hardware. Both products take best-of-the-S3-class scores for raw throughput on our VGA performance tests. They additionally offer leading-edge performance under Windows, as evidenced by their strong weighted performance indexes in 16- and 256-color modes. On our Windows tests, they are from three to five times as fast as a dumb frame buffer card in 16-color mode, and eight to eleven times as fast as a standard VGA adapter in 256-color mode. In 16-color graphics applications on our Windows tests, they were the two fastest boards of all; in 256-color mode, they take second and third place only to the ATI Graphics Ultra. Those scores are particularly important for this class of boards, as Windows users form a large part of their target audience.

The Diamond and Portacom boards come in at the low end of the pricing spectrum. Their respective $445 and $325 price tags include a Sierra HiColor RAMDAC—a feature that boosts the cost of some other products in this review to $495 (in fact, the STB board costs that much without the Sierra HiColor chip!).

Both boards are crafted using surface-mount circuitry, and the Diamond accommodates a VESA-style feature connector. While eight banks of jumpers make the Eclipse II slightly tricky to install, for most users that poses a one-time problem that is readily overcome. With few jumpers, the Diamond couldn't be easier to install, but the card could use a little performance boost under *AutoCAD*—maybe in the form of better drivers. Even so, its slightly off-center performance in that environment certainly didn't keep the S3 chip as a class from garnering the top-performing *AutoCAD* scores. All in all, you won't find a better price/performance bargain than the Diamond or the Portacom.

HONORABLE MENTION

An honorable mention must go to the ATI Graphics Ultra. Across the board, the Graphics Ultra performed the fastest on our VGA performance tests. In 256-color mode on our Windows benchmark test, it beat the rest of the competition, but not always by a wide margin. It did outperform its lower-priced sibling, the $599 ATI Graphics Vantage, on these tests hands down. (The Vantage took the lead over the Ultra on the 16-color Windows tests, but neither ATI board could compete in that arena against the top-performing S3 boards.)

Extra value comes in the form of the ATI Graphics Ultra's 8514/A compatibility at the register and interface levels and the included Crystal Fonts. But this power does come at a price: It currently costs $899 for the board with 1MB of VRAM. Even with a projected March 1 price drop to $699, that's more than many users who are looking for accelerator boards will want to spend. That's particularly true when they can get nearly equal or even better performance under Windows with less-costly, S3-based boards such as the Diamond Stealth VRAM and the Portacom Eclipse II.

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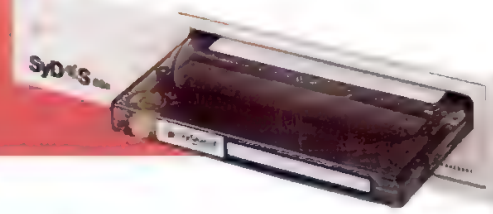

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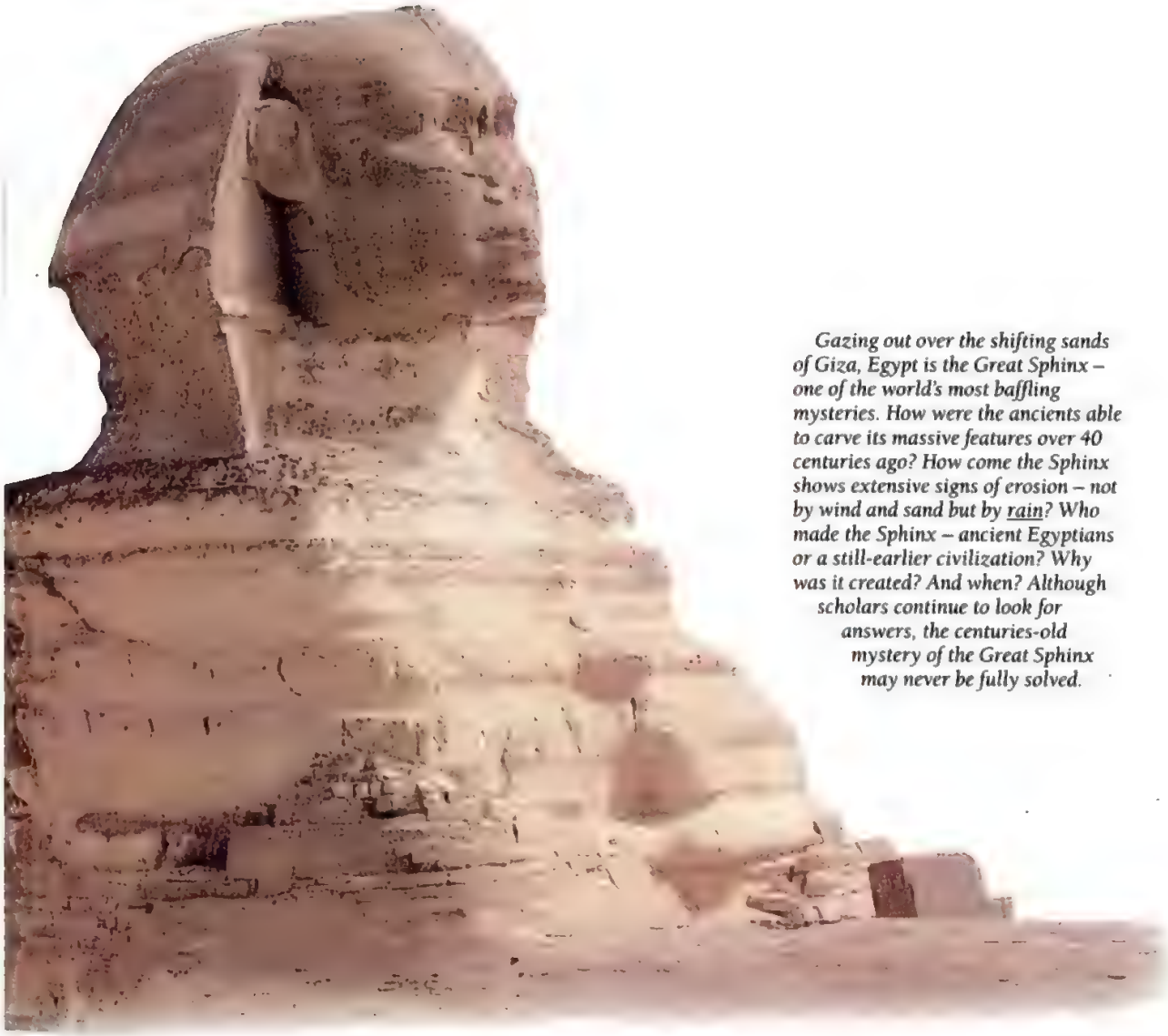

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CODE A2605

display adapter circuitry built right into them, most people are not aware of the fact that they are designed to operate at the same speed as if the display adapter were an expansion card.

The new designs tie the adapter into the local bus of the CPU, so data can be transferred at much higher rates than it can through the ISA or EISA bus. This should give frame buffer designs a huge performance boost at little additional cost, but it is too soon to tell. And if frame buffers should be successful on the CPU local bus, it is entirely possible that accelerated designs could also benefit from the higher data transfer rates, thus offering even faster performance.

Still another effort to boost video performance, but only on EISA and MCA systems, involves using the bus mastering capabilities of those expansion architectures. IBM's new XGA design is one example of this approach. XGA is IBM's coprocessed replacement for the non-coprocessed 8514. This approach shares one drawback with the local bus video approach: In order to take advantage of it, most users will have to purchase entirely new systems.

Your choice of video card and desired resolution will influence the monitor you choose.

MAKING A CHOICE

So what do you do if you want the best possible video performance for Windows or even CAD applications? Run the fastest CPU you can afford, and when price is a consideration, use an accelerated video adapter. Keep in mind that your choice of video card and desired resolution will have an impact on the monitor you choose. Monitors capable of the preferred 72-Hz refresh rate often cost more than the rest of the pack, although this is less of an issue this year because most of the better monitors support 72 Hz. And monitors that can run at 1,024-by-768 resolution in noninterlaced mode often cost much more than those capable of just 800-by-600 resolution.

Also remember that the combination of refresh rate and high resolution has more impact on total system cost than on overall performance. So if you can afford the cost of a suitable monitor, go for the highest refresh rate and resolution it will support.

Then sit back and watch your Windows screens fly.

ACTIX SYSTEMS INC.

Actix GraphicsEngine Display Accelerator

by Kellyn Betts

The $379 Actix GraphicsEngine Display Accelerator is the third product to bear the name of this 10-employee, 19-month-old company. An S3-based board, the product offers mediocre performance on our VGA tests when compared with other boards using the same accelerator chip, though its performance on our Windows Benchmark Tests is more in keeping with its S3-based competitors.

The Actix adapter was hampered by 1-wait-state performance, which accounts in part for its low-end scores on our VGA tests. Its performance indexes on our Windows tests place it, in general, as one of the midrange performers in that area. It didn't stray from the fine *AutoCAD* times achieved by all boards using the S3 chip.

We were unable to test the board with 32K colors, even though its specifications support the inclusion of a Sierra HiColor RAMDAC in place of the straight, socketed DAC found on the review unit. The new 80-MHz Sierra chips that the board requires weren't ready at the time of our review (neither, of course, were S3's drivers to exploit any Sierra chip). Actix promised Sierra RAMDACs as soon as they are made available and also a $20 upgrade (shipping cost) for those users who purchase the board in its present state.

This congenial upgrade policy complements the company's one-year warranty on parts and labor and toll-free technical support line (9 A.M. to 6 P.M. weekdays, P.S.T.). Unfortunately, the company does not operate a BBS for easy access to updated drivers. The board comes with pleasant, diagram-filled documentation and is easy to install. It can display resolutions up to 1,280 by 1,024 in non-Windows applications such as *AutoCAD*, 1,024 by 960 in Windows, and comes with high-resolution drivers for a number of popular software packages, including six CAD programs: *AutoCAD*, *CADkey*, *CADvance*, *Generic CADD*, *Microstation*, and *VersaCAD*.

The board uses Version 1.04 of the S3-supplied BIOS, which does not fully implement VBE compatibility. But the company supplies proprietary drivers that allow users access to VESA-compliant refresh rates in 800-by-600 and 1,024-by-768 modes.

Actix's other products are aimed at the high end of the mainstream VGA marketplace. The $219 (1MB) Spectrum VGA is a Tseng ET 4000–based board with a Sierra HiColor RAMDAC, and the boards in its Tiger-10V line sport a Texas Instruments 34010 coprocessor. The GraphicsEngine itself is available with 512K RAM for $325.

The Actix GraphicsEngine is not a bad choice in accelerator boards; CAD users will likely find that it meets their needs, and Windows users will get solid, midrange performance where it counts. Its price, however, is a little high for the performance value; other S3-based boards offer more power for the same money.

FACT FILE

Actix GraphicsEngine Display Accelerator
Actix Systems Inc., 4633 Old Ironsides Dr., #310, Santa Clara, CA 95054; 800-927-5557, 408-986-1625.
List Price: $379; Sierra HiColor RAMDAC upgrade, $20.
Requires: VGA monitor or better.
In Short: The S3-based Actix GraphicsEngine Display Accelerator provided poor performance on our VGA tests, although its midrange performance on our Windows tests compensates for this drawback. Its price, however, is equal to that of some higher-performing S3-based boards. A price drop might be in order.

CIRCLE 483 ON READER SERVICE CARD

ARTIST GRAPHICS

Artist Graphics WinSprint 100

by Alfred Poor

Artist Graphics is a company best known for its high-resolution, high-speed graphics adapters with graphics coprocessors.

Most of its products for Windows rely on the Texas Instruments 34020 processor and are priced accordingly. But the company has an entry-level product based on the Chips and Technologies 82C453 VGA accelerator: the WinSprint 100. Unfortunately, this card does not enhance the reputation of the rest of the line.

With a list price of $395, the WinSprint 100 is priced competitively with the other boards in this review, though it is not the least expensive. And while this card comes with good documentation and lots of drivers, nothing can counter the fact that it falls far short of the competition in terms of performance on PC Magazine Labs' Windows Benchmark Tests.

In the 800-by-600 Windows tests, using our indexes, the WinSprint 100 was the slowest card in the group next to the Hornet entry. It was not just marginally slower: It was three to four times as slow as the other products across the entire range. The WinSprint 100 was more competitive in the *AutoCAD* tests. Its best performance was on our VGA tests, where its 82C453 chip compared favorably with ATI's Mach 8 chip.

Part of the reason for its slower showing among its competitors in some areas may lie in the fact that it doesn't accelerate operations the way the other accelerator chips in this review do. Instead of hard-coding bitblt (bit-block transfer), line drawing, and other graphics functions into

FACT FILE

Artist Graphics WinSprint 100
Artist Graphics, 2675 Patton Rd., St. Paul, MN 55113; 612-631-7800.
List Price: $395.
Requires: VGA monitor or better.
In Short: A five-year warranty and the ability to display 1,024-by-768 noninterlaced images in 256 colors are not enough to compensate for the WinSprint 100's slow Windows performance. There are better choices.

CIRCLE 491 ON READER SERVICE CARD

MAKING WINDOWS FLY

Want faster performance under Windows without buying a new graphics adapter? Here's how.

by Alfred Poor

If you're running Windows, there are a number of changes you can make to improve performance, even if you're not using a graphics accelerator board. The following list should give you plenty of suggestions.

- *Resolution and number of colors.* These have an impact on Windows performance. Try to keep your resolution and the number of colors to a minimum. For example, most Windows applications cannot use or do not need more than 16 colors; word processors, spreadsheets, and communications programs are prime examples. It's only necessary to have 256 colors if you're doing lots of graphics image editing, as you might with a presentation graphics package or when scanning color photographs. And "high-color" drivers for 32K- or 64K-color RAMDAC can slow performance even more drastically if you take advantage of using the increased colors they offer. Use colors sparingly.

  Run at higher resolutions only to fit more on the screen (preferably on a larger monitor) or when you want finer resolution of text or graphics.

- *Wallpaper.* Using a bitmapped image as your desktop wallpaper is pretty, but you pay a small price in display performance—probably about 2 percent even when it isn't showing. A gray or solid color background may not be exciting, but it will speed up your system a bit.

- *Fonts.* Some cards, such as ATI's Graphics Ultra and Graphics Vantage or those using the Edsun Continuous Edge Graphics (CEG) technology, offer special drivers that use anti-aliasing to make Windows screen fonts look smoother. While this can make text look much better—especially at lower resolutions—these drivers can exact a significant toll on display speed on some systems. If your system is fast enough that you don't see the performance difference, go ahead and use them.

  If that's not the case and you do need smoother fonts, you may want to avoid anti-aliasing and just try a higher resolution. Though this can also have an impact on speed, some cards will provide a text image of nearly the same quality at the next higher resolution even more quickly than when they use one of the anti-aliasing approaches at a lower resolution. With the right screen fonts, higher resolutions will use more pixels per character and so look smoother without using the anti-aliasing drivers.

- *Vendor-supplied drivers.* Be sure you're using the most up-to-date version of your card's drivers. Many manufacturers run bulletin board systems that constantly have the latest versions available for downloading. You can also check CompuServe to see if your vendor runs a forum there or is represented in one.

- *Third-party alternatives.* There are also some third-party drivers you can get to speed up a standard VGA or Super VGA adapter, such as the *WinSpeed* Windows drivers available from Panacea. Congruent Corp. (New York, New York) also offers drivers to speed up performance, but only to video board vendors.

  The Panacea drivers support 256 colors in VGA at resolutions of 800 by 600 and 1,024 by 768 and will work with a wide range of Super VGA boards: ATI, Trident Microsystems, Video Seven/Headland Technology, and Western Digital Imaging's Paradise video series, as well as any board using the Tseng ET 4000 chip. For the $79 list price of *WinSpeed*, you can get a significant boost in Windows display performance. PC Magazine Labs found a 10 to 20 percent increase on many parts of the Windows benchmark tests, with some important graphics functions improving by 50 to 400 percent! (We report the results of using the Panacea drivers with an ATI VGA-Wonder XL Plus Super VGA board in

the controller and off-loading those processes from the host CPU, the 82C453 chip relies on a technique called single-cycle read-write-modify operation. Unlike the other products, with the Artist board, the host CPU is still involved in bitblting and line drawing. The difference is that instead of two bus cycles occurring—as would happen with any dumb frame buffer—only a single bus cycle occurs. The result is speedier host-directed bitblts, line draws, font rendering, and other specific graphics operations than would normally occur with a standard video card. The speed increase, however, is not as great as you get with most of the other accelerator cards.

The WinSprint 100 board's BIOS is VBE-compatible. But the board we tested was not able to provide a vertical refresh rate higher than 60 Hz, which is a significant drawback in the light of the VESA-recommended 72-Hz refresh rate. (Note that the company has started shipping an updated version of the card that it says supports the higher refresh rate, but it was not ready in time for our tests. The updated board will sell for the same price.)

SOME STRENGTHS

The WinSprint 100 has its strengths. It comes standard with a full megabyte of VRAM and is capable of producing non-interlaced images up to 1,024-by-768 with 256 colors. It has a full complement of drivers for a wide range of applications, including many different CAD programs. For certain DOS character-based programs such as *Framework, Lotus 1-2-3, Lotus Symphony*, and *WordPerfect*, it is able to produce high-resolution text modes with up to 132 columns and 44 lines per screen.

The documentation is adequate, though there were some contradictions. There are many extras, such as a plastic sticker for your monitor, a Rolodex card with the technical-support number, and the name and extension number of the individual to call for tech support. The company provides toll-free technical support weekdays from 7 A.M. to 6 P.M. (C.S.T.) and operates a BBS. The WinSprint 100 also comes with a five-year warranty on parts and labor.

All in all, however, the extras don't make a winner out of this card. Its cost is equal to that of the other, higher-priced accelerator boards, but its performance in the Windows environment is not.

the Windows Benchmark Tests found in this roundup.)

SPEED ASIDE

Though not a speed-related issue, many users are concerned about how to best employ screen fonts. As far as Windows screen fonts go, keep in mind that their actual size is a function of which screen fonts you use, not the resolution. Windows defines screen fonts in terms of pixel blocks—how many pixels a letter will use. Since this isn't strictly a function of resolution, you can use what Windows calls its VGA character set in 800-by-600 or 1,024-by-768 mode. The letters will just come out very small—something users who bought 20-inch monitors so they can fit more text on the screen at one time might want. You can also do the reverse and use the 8514 characters on your 640- by-480 display and get some larger letters. Here's what you do:

The first step is to make sure that your \WINDOWS\SYSTEM directory contains the fonts files that you want to use. The VGA files are called VGAFIX.FON, VGAOEM.FON, and VGASYS.FON. The 8514 files designed for 1,024-by-768 resolutions are 8514FIX.FON, 8514OEM.FON, and 8514SYS.FON.

Next, edit your WIN.INI file, which is a text file in your \WINDOWS directory. Since it is a text file, you can use Notepad for editing. Near the top of the file, you will find three lines that look like this, if you have the 8514 fonts selected:

```
FIXEDFON.FON=8514FIX.FON
OEMFONTS.FON=8514OEM.FON
FONTS.FON=8514SYS.FON
```

Replace the references to the 8514 fonts with the names of the VGA fonts, close Windows and restart it, and your fonts will appear in their new size.

As a rule of thumb, most people prefer the 8514 screen fonts with high-resolution displays on monitors that are 15 inches or smaller, while the VGA screen fonts work well for the high- resolution displays on monitors that are 16 inches or larger. ■

Panacea WinSpeed

Panacea Inc., Post Office Square, #4, 24 Orchard View Dr., Londonderry, NH 03053; 800-629-7420, 603-437-5022.

List Price: $79. **Requires:** ATI VGAWonder, VGAWonder Plus, or VGAWonder XL Plus; STB Ergo, Ergo/MC; Trident Microsystems 8800 or 8900 Series; Video Seven/ Headland Technology VRAM, FastWrite, 1024i, or VRAM II; VivdVUE HiColor; Western Digital Imaging's Paradise VGA 1024 or Professional VGA/VGA16; Wyse 455 VGA, 470 VGA, or 7500 VGA; Zymos 51 series, or any VGA or Super VGA board using a Tseng ET 4000 chip.

CIRCLE 495 ON READER SERVICE CARD

ATI TECHNOLOGIES INC.

ATI Graphics Ultra
ATI Graphics Vantage

by Mitt Jones

The ATI Graphics Ultra and Graphics Vantage build on the same design as the ATI 8514/Ultra, including ATI's 8514/A-compatible Mach 8 processor, but minus the MCA compatibility. The "Graphics" in their names signifies that ATI has integrated VGA capabilities into the boards—via the same ATI chip used in the Sierra HiColor-equipped VGAWonder XL—instead of requiring that you pair the board with a separate VGA adapter using a pass-through edge connector. For all standard VGA modes, the Wonder XL chip, coupled with its own 512K DRAM, maintains full control. For graphics modes at higher resolutions, the Mach 8 takes over, using its own complement of RAM.

The differences between these two latest ATI offerings are purely price and speed. The Graphics Ultra employs fast VRAM on the Mach 8 side and carries a retail price of $699 with 512K VRAM or $899 with 1MB. The Graphics Vantage uses slower, less expensive DRAM and

FACT FILE

ATI Graphics Ultra
ATI Graphics Vantage
ATI Technologies Inc., 3761 Park Ave., Scarborough, Ontario, Canada M1W 3S2; 416-756-0718.
List Price: Graphics Ultra, $899; Graphics Vantage, $599.
Requires: Fixed-frequency analog VGA monitor for standard modes; multifrequency analog monitors supporting refresh rates to 72 Hz and resolutions as high as 1,024 by 768 for all extended and enhanced modes.
In Short: Differing only in the type of memory used on the Mach 8 chip, the Graphics Ultra and the Graphics Vantage pair register-level VGA and 8514/A compatibility in a design that includes a handy monitor configuration utility and ATI's welcome Crystal Font capability. Both boards turned in impressive performances on our VGA tests. And on our Windows tests, the ATI Ultra blew away the competition in 256-color mode, while the Vantage nearly managed to match its competitors.

CIRCLE 485 ON READER SERVICE CARD

lists for $499 with 512K and $599 with 1MB. (Even though they cost more than $500, we included the Graphics Ultra and Graphics Vantage because of high customer interest in these products.) Additionally, by the time you read this, ATI should have lowered its 1MB list prices to $499 for the Graphics Vantage and $699 for the Graphics Ultra (the change was due to take effect March 1). At those list prices, expect street prices of about $350 and $550. Each board includes a mouse port along its back bracket and comes with a Microsoft-compatible 400-dot-per-inch bus mouse. Neither includes the Sierra HiColor RAMDAC.

As expected, given their identical VGA controller and amount of VGA RAM, the two ATI entries performed identically on PC Magazine Labs VGA Performance Tests—far faster than the S3-based entries overall. *AutoCAD* users will find that the ATI Mach 8 chip performs at generally middle-of-the-pack speed.

Under Microsoft Windows 3.0, results were more interesting. Across the board in 16-color mode, the Ultra and Vantage achieve performance indexes considerably lower than they are at 256 colors. An ATI spokesperson reports that the poor performance in 16-color mode is being remedied. Given that you must disable half of the 1MB of memory on the Mach 8 side to force the board to 16 colors under Windows and that performance is markedly better at 256 colors, however, the point seems moot: Leave the Vantage in 256-color mode under Windows and it will perform almost as well as its S3-based competition; leave the Ultra in 256-color mode and it will far surpass most of its S3-based competitors.

MORE THAN JUST SPEED

The allure of these boards only begins with speed, however. Given the boards' compatibility with the 8514/A at both the register and applications-interface levels, you should have no problem convincing these controllers to run in accelerated modes with any remotely contemporary application. ATI also ships the board with a prime selection of drivers optimized for the Mach 8, including *AutoCAD, CADkey, Lotus 1-2-3, Lotus Symphony, Ventura Publisher* (GEM version), and Windows 3.0. OS/2 Presentation Manager drivers were due in January. Of course, the VGA side of the board maintains full VGA register-level compatibility.

The Ultra and Vantage are just as flexible when it comes to monitor refresh rates. Instead of allowing you one of only a few combinations across the available video modes, the ATI offerings come with a configuration utility that gives you a wide-ranging choice. Once you've specified the frequencies appropriate for your monitor, the utility writes these into EEPROM for future use. This task, as well as installation as a whole, is achieved without flipping so much as one DIP switch. ATI provides a menu-driven installation routine for provided applications drivers.

Those who have invested in a monitor capable of handling the VESA-recommended 72-Hz refresh rate should also appreciate the boards' ability to maintain it. (The ATI boards are not VBE-compatible, however.) Unlike most of the competition, the Ultra and Vantage can drive the monitor at 72 Hz across VGA, Super VGA, and high-resolution modes without a proprietary driver. ATI claimed that it would support a 76-Hz refresh rate in 1,024-by-768 mode as of January.

For many buyers, however, the most appealing feature of these boards will be ATI's built-in Crystal Fonts capability for Windows 3.0. Crystal Fonts allows, among other things, truly readable text that is as small as 6 points—even on a 14-inch monitor—at the boards' top resolution of 1,024 by 768. With the help of the Mach 8's built-in font-scaling support, it provides 13 fonts that can be scaled from 2 to 127 points in hardware, quickly and on the fly. ATI employs an anti-aliasing technology developed at MIT to smooth the characters' edges, making them appear nearly as sharp on-screen as they would on the printed page.

Of course, for those with a 20-inch monitor, for which readable text isn't such an issue, ATI also provides a Windows driver that uses small characters to leave more clean viewing space.

The Graphics Ultra and Graphics Vantage are not without their faults. One would guess, for instance, that most buyers would be happy to pass on the 400-dpi mouse for a drop in price. And how strong these offerings are when it comes to speed depends to a large degree on whether you're talking about the Ultra or the Vantage: The Ultra clearly wins against the S3-based competition, but it does so at a substantially higher price.

Crystal Fonts capability, breadth of software and monitor support, and ease of installation are all points in the ATI products' favor. In addition, excellent documentation, a five-year warranty on parts and labor, and free (though not toll-free) technical support via phone (weekdays 9 A.M. to 5:30 P.M., E.S.T.) or 24-hour BBS, also enhance the ATI products. Assuming ATI follows through on its announced March 1 price decrease, these boards should remain—and rightfully so—among the more popular of the medium-range graphics adapters.

CSS LABORATORIES INC.

CSS Maxgraphics/16

by Kellyn Betts

CSS Laboratories has been around as a computer manufacturer for seven years. Its CSS Maxgraphics/16 represents the engineering-oriented company's first foray into the PC graphics marketplace. The board we tested is based on the S3 chip and includes a Sierra RAMDAC. Its $495 price puts it at the high end of our line-up, even among most other boards that include a Sierra HiColor RAMDAC.

The FCC Class B–rated board is populated with fast 80-nanosecond VRAM chips and has a VESA feature connector. CSS uses Version 1.5 of the S3-supplied

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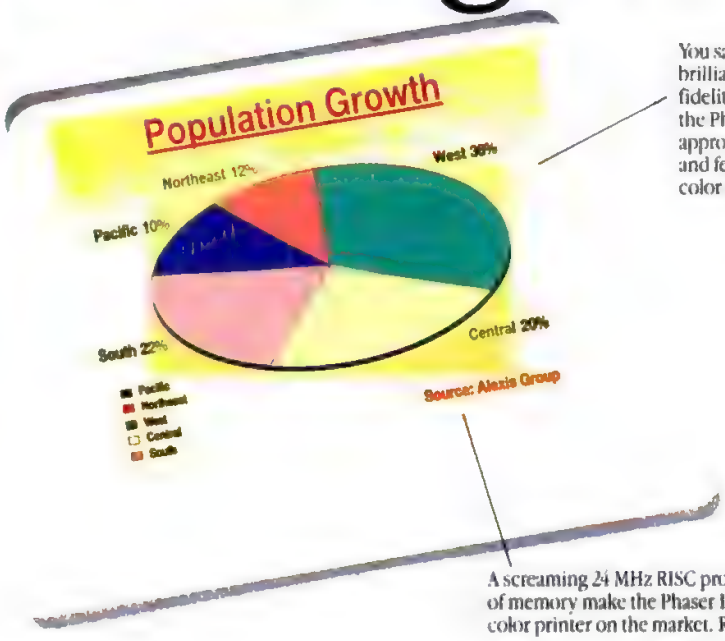

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CIRCLE 001 ON READER SERVICE CARD

FACT FILE

CSS Maxgraphics/16
CSS Laboratories Inc., 1641 McGaw Ave., Irvine, CA 92714; 714-852-8161.
List Price: $495.
Requires: CGA monitor or better.
In Short: The S3-based CSS Maxgraphics/16 offers the advantages you'd expect from such a board. Compared with its peers, however, its $495 price seems a bit too dear.

CIRCLE 486 ON READER SERVICE CARD

BIOS, which does not fully implement VBE compatibility. Proprietary drivers, however, allow it to maintain a VESA-compliant 70-Hz refresh rate at 1,024-by-768 resolution with 16 colors. It can display up to 16 colors in 1,280-by-1,024 resolution in *AutoCAD*.

The Maxgraphics/16 comes with the standard assortment of high-resolution drivers that S3 distributes with its chip. Drivers for OS/2 Presentation Manager and *Ventura Publisher* were planned for January.

We were unable to test the board's Sierra RAMDAC because S3 has not yet provided a driver, though it should be available by the time you read this. The board's *AutoCAD* showing mirrored what you would expect from an S3-based product: generally above-average scores on our Windows text- and graphics-intensive applications tests at 16 colors. The Maxgraphics card garnered scores on the higher side of midrange on our VGA tests.

Even though there are 11 jumpers for setting up the Maxgraphics/16 to work with the monitor you'll use and for other options, it's still fairly easy to install. The manual could provide more detail, though. The board comes with an 18-month warranty on parts and labor and the company offers toll-free technical support weekdays from 6 A.M. to 7 P.M. (P.S.T.).

The CSS Maxgraphics/16 is a solid option, but it's priced a little too high to represent the best bargain in this bunch.

The Maxgraphics/16 garnered scores on the higher side of midrange on our VGA tests.

HARDWARE
GRAPHICS ACCELERATORS

COMPUTER SYSTEMS INC.

Diamond Stealth VRAM

by Winn L. Rosch

Speedy but not surreptitious, the Stealth VRAM from Diamond Computer Systems will sneak its way into your heart with its rapid graphics performance, high resolution, moderate price, and multicolor abilities.

The basic Stealth includes 1MB of VRAM and a Sierra HiColor RAMDAC as standard equipment, for a total of $445. (Diamond recently changed its standard option offering to this configuration; previously, the base board was sold with 512K RAM and the Sierra HiColor RAMDAC was an option.) Although the board is too new to have established a street price, figure about $299 for the current standard configuration.

The Stealth is based on S3's 86C911 accelerator, but Diamond claims to have improved the chip's performance by enhancing the S3 drivers. In fact, it earned top honors on PC Magazine Labs' 16-color Windows tests, and commended itself quite favorably when upped to 256 hues on the Windows tests. It was second only to the higher-priced ATI Graphics Ultra on the 256-color Windows tests. On our VGA tests, it shared best-of-the-S3-class scores with Portacom.

The board is amazingly compact, just about 6.75 inches long and XT-height. Most of the circuitry is surface-mounted and a VESA-style feature connector (a header) allows future enhancements.

The Stealth supports a 72-Hz refresh at 800-by-600-pixel resolution and either 60 Hz or 70 Hz at 1,024 by 768. Unfortunately, interlacing is required at its top, non-Windows 1,280-by-1,024 resolution level—at a horizontal frequency of 48.9 KHz. Including 1MB in the standard configuration was a good move, as it is required (as with other boards) for 256-color operation beyond VGA, for 16 colors at 1,280 by 1,024, or if you want use of the Sierra RAMDAC.

Diamond wrote VESA program calls into its proprietary (rewritten S3) BIOS and claims 100 percent VBE compatibility in its BIOS. We were unable to detect this on our tests, however. On the other hand, the Diamond-supplied Windows and display-list *AutoCAD* drivers worked flawlessly.

The Stealth is easy to get going, having only two jumpers for setup; one that was used for VRAM size selection—no longer necessary since the move to 1MB as standard equipment—and another for enabling/disabling the 16-bit BIOS. A four-switch DIP bank for matching monitor type for best refresh rate and enabling speed-enhancing features such as fast BIOS support is also present. The switches are accessible through the board's rear panel after installation and are well documented in the Stealth manual.

If you have trouble, Diamond offers a 24-hour BBS, free (but not toll-free) support during West Cost business hours, and a five-year warranty on parts and labor. Choose the Diamond Stealth VRAM to sneak the best speed into your graphics-based applications without stealing too much from your bankroll.

FACT FILE
EDITORS' CHOICE

Diamond Stealth VRAM
Diamond Computer Systems Inc., 532 Mercury Dr., Sunnyvale, CA 94086; 408-736-2000
List Price: $445.
Requires: VGA monitor or better.
In Short: The Diamond Stealth VRAM is a compact, top-performing graphics accelerator board. It garnered high marks on our Windows and VGA tests, boasts easy installation, and includes a Sierra HiColor RAMDAC. This is one graphics board you won't want to overlook.

CIRCLE 487 ON READER SERVICE CARD

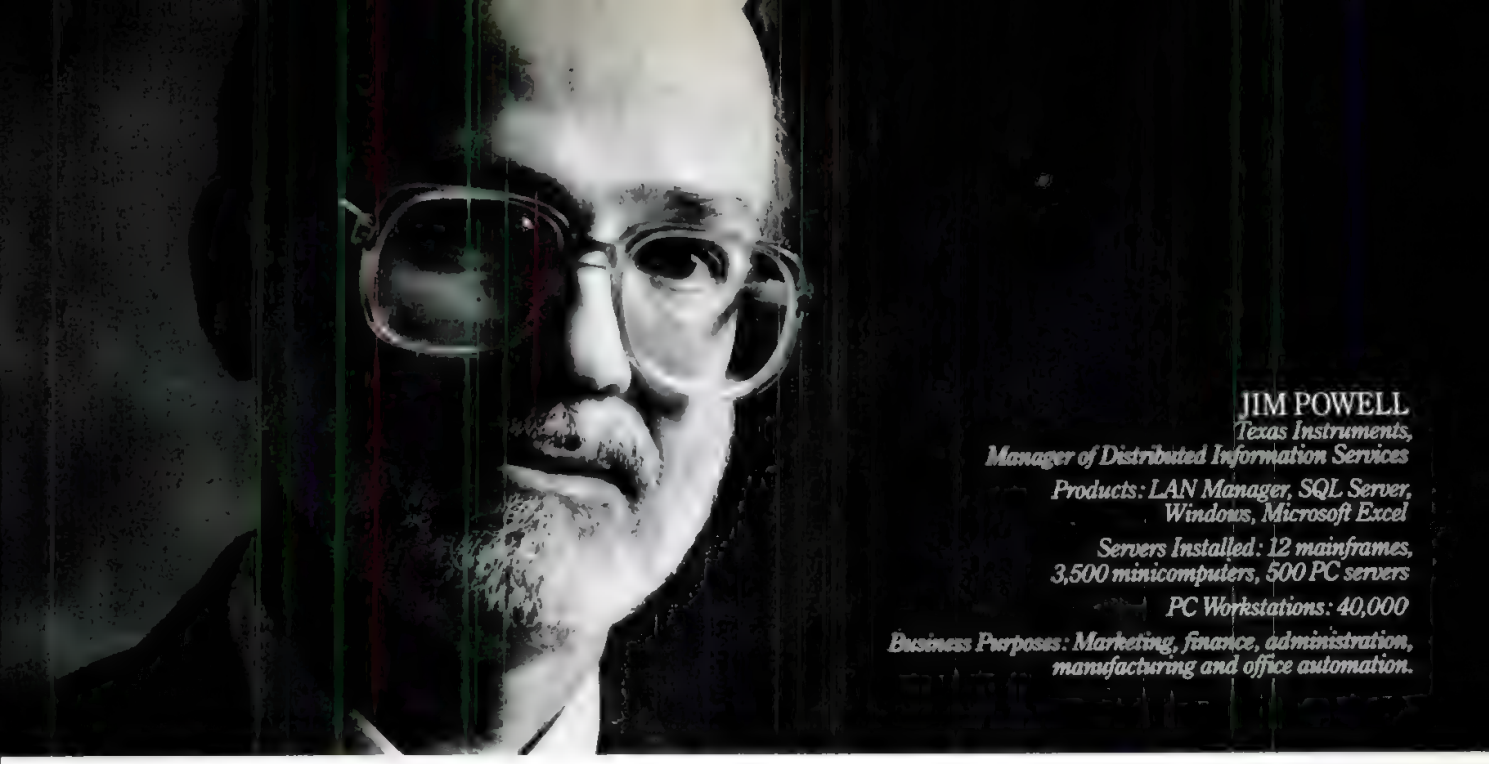
GENOA SYSTEMS CORP.

Genoa WindowsVGA

by Mitt Jones

Like most companies that offer S3-based accelerators at this writing, Genoa Systems seems to have focused on getting a solid, no-frills offering to market as soon as possible. The $495 Genoa WindowsVGA evaluation unit offered few surprises during testing, as well as good performance on our Windows tests, and a feature or two that help make it an accelerator worth considering.

Available in only one memory con-



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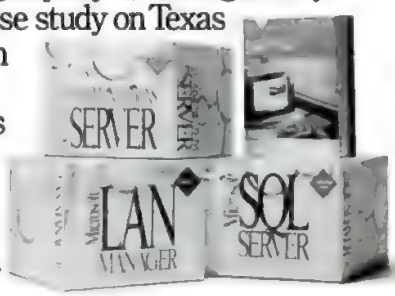

Microsoft

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Adobe Streamline Windows	119
Adobe Type Manager Windows	59
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Ami Pro 2.0	275
Toolbook	279
Becker Tools	69
Borland C++	299
Charisma	320
Corel Draw 2.0	359
Crosstalk for Windows	115
IBM Current	211
dBFast	269
Designer	439
Drafix Ultra Windows	407
Facelift for Windows	59
Facelift for Windows ValuePak	117
Form Base w/Windows	295
Form Publisher	105
Grammatik for Windows	55
hDC FileApps for Windows	69
hDC FirstApps for Windows	53
hDC ICON Designer	32
hDC Windows Express	53
Lotus 1-2-3 for Windows	395
MS Entertainment I,II,III	25
MS Excel for Windows	293
MS PowerPoint for Windows	293
MS Productivity Pack	36
MS Project for Windows	412
MS Word for Windows	293
Norton Desktop	93
Norton Backup	82
Objectivision	94
Omni Page 386	432
On Target	253
PC-Kwik Power Pak	69
PageMaker 4.0	499
PerFORM Pro	176
PFS Professional Write Plus	158
Read Write Windows	290
Superbase 4	450
Ventura Publisher Gold/Windows	499
WinConnect	59
WINFAX Pro	70
WordPerfect for Windows	256
Wordscan 286/386	192
Wordscan + 286/386	642

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Brooklyn Bridge	82
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Logitech Mouseman Serial Cordless	82
Microsoft MS BallPoint Mouse	110
MicroSpeed MicroTrac	54
Thumbelina Portable	59
VGA Dimmer	23

PALMTOP

Poqet Hand Held	☎ $329
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NOTEBOOK

AST	
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Tempo LX 386SX 20	1955
NoteStar	
386SX-16 2/60 MG,1.44 VGA	1609
386SX-20 2/40 MG,1.44 VGA	1749
386SX-20 2/80 MG,1.44 VGA	1802
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All Models	Call
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3000 20MB	929
3000 40MB	☎ 2149
3000 WINSX 386/80	2865
Other Models	Call

CD ROM

NEC	
CD ROM INT CDR-36 XT/AT w/int	$455
CD ROM EXT CDR-36 Ref Bundle	565
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CD ROM INT CDR 83	579
Panasonic Worm 940 MB	2389
Sony	
CD ROM INT w/ref bundle	419
CD ROM EXT	475

SOFTWARE

Accumail	$110
Atlas Pak	63
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Grolier's Electronic Encylopedia	209
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NETWORKING & LAN

SOFTWARE

Above LAN	$235
ACCPAC BPI LAN	230
Data Ease LAN 3-Pak	489
DBase IV Lan	609
Direct Access Network Unlimited	355
Foxbase Plus LAN	279
FoxPro Lan 2.0	739
Harvard Graphics LAN Server	350
MS Excel Exec License Pack	234
MS Word License Pack	174
Novell NetWare Lite	65
Novell NetWare 286 5 Pk	485
Novell NetWare 386 10 Pk	1379
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PC Anywhere IV LAN	315
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R-Base 3.1 LAN	579

HARDWARE

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NE2 Netw LT Combo Add on (3.5)	$259
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Netwr LT Cmbo NE/2000 Strt (5.25)	400
Artsoft	
Lantastic 2MBPS Starter	330
Lantastic Ethernet Starter	☎ 459
Standard Microsystems	
Ethercard Plus 8 bit Elite	135
All Other Models	Call
Tiara	
All Other Models	Call

CAD & ENGINEERING

Auto Sketch 3.0	☎ $139
Design CAD 3-D	185
Generic CAD 5.0	279
Generic CAD Starter Kit Level II	85
Math CAD	295
Summasketch 12x12 II	309
Summasketch 12x18 Pro II 4 Button	539
Summasketch 12x18 Pro II 16 Button	539
Turbo Cadd	75
CalComp	
33120-34 Dig12x12 16B	299
33120-34 Dig12x12 4B	289
33180-4 Dig12x18 4B	599

MICE

Logitech Mousemen Serial /PS2	$65
Logitech Trackman Serial	65
Logitech Trackman Portable	93
MS Ballpoint Mouse	☎ 110
MS Bus or Serial w/Windows 3.0	142
Microspeed PC Trac Ser or PS/2	70
Mousepen Pro - PC	59

DISKETTES/TAPES

Sony	
3.5 D/S D/D (100)	$70
3.5 H/D (100)	115
5.25 D/S D/D Disks (100)	50
5.25 High Density (100)	87
3M Tape 20-40 MB/3.5	15

PCM31792

OCR/SCANNERS

HARDWARE

Complete	
Full Page GS/w Wordscan	$639
Half Page 400 DPI	☎ 109
DFI	
Scanner HS-3000+	145
Logitech	
Logi Scanman 256 for PS/2	289
Logi Scanman 256	259

SOFTWARE

CAT Reader Pro 1/2 Page	$155
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Complete OCR/HP + 400	☎ 175
Omnispell	64
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  - 1695 289
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  - NX 1001 139
  - NX 1020 Rainbow 185
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  - 2400 ETC EXT 149
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  - Communicator 290
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  - XC 1429 C VGA 389
  - Other Models Call
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  - Multisync 4FG 15" 765
  - Multisync 5FG 17" 1345
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  - Princeton Ultra 1400 450
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  - **Jumbo 60/120 INT** ☎ 195

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- MS DOS 5.0 Upgrade 59
- MS DOS 5.0 OEM 49
- **MS Windows Ver. 3.0** ☎ 88

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- Pacific Data 1-2-4 Plus 4 MG 350
- Pacific Data 25 IN 1/III 259
- Pacific Data 4 Memory 1MB 97
- **Pacific Data 4 Memory 2 MB** ☎ 139
- Pacific Data 4 Memory 4MB 235

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- ATI
  - VGA Wonder XL 256K $165
  - **VGA Wonder XL 512K** ☎ 185
- Diamond
  - Speed Star Hi-Color 179
  - Speed Star Plus VGA 169
- Everex
  - RAM 3000 Deluxe 79
  - RAM 8000 170
- Hercules
  - All Models Call
- Intel
  - Above Board + 512K Plus 275
  - Above Board + w/2MG P/S 445
  - Above Board + w/2MG Expands to 8 MG 409
  - Inboard 386 PC (1MG) 489
  - Other Models Call
- Orchid
  - Tiny Turbo 286 118
  - Tiny Turbo Xtra 175
  - Other Models Call
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  - VGA + 16 125
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  - Other Models Call
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- **Toshiba 3.5 1.4 MG** ☎ 59

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- DAC Easy Bonus Pack 4.2 122
- DAC Easy Payroll 4.2 59
- Pacioli 2000 27
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- TimeSlips III 4.0 185

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- Mirror III 79
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CIRCLE 206 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

	Actix GraphicsEngine Display Accelerator	Artist Graphics WinSprint 100	ATI Graphics Ultra	ATI Graphics Vantage	CSS Maxgraphics/16
List price	$379	$395	$899	$599	$495
Graphics accelerator chip	S3 86C911	C&T 82C453	ATI Mach 8	ATI Mach 8	S3 86C911
ACCELERATOR CAPABILITIES					
BitBlts	■	❑	■	■	■
Line draws	■	❑	■	■	■
Area fills	■	❑	■	■	■
Image transfers	■	❑	❑	❑	■
Raster operations	■	❑	■	■	■
Hardware cursor	■	❑	❑	❑	■
Other	None	■ (single-cycle read-modify-write operation)	■ (zoom/clipping, pattern fill, font-scaling assist)	■ (zoom/clipping, pattern fill, font-scaling assist)	None
VGA SUPPORT					
VGA BIOS manufacturer	AMI	C&T	ATI	ATI	AMI
Version number	1.04	453 VGA BIOS, Version 1.2.0	1130111513	1130111513	1.5
Revision date	10/31/91	11/22/91	N/A	N/A	9/20/91
VBE compatibility	Proprietary drivers	ROM BIOS	TSR	TSR	Proprietary drivers
VGA chip set manufacturer	S3	C&T	ATI	ATI	S3
Type of display memory	VRAM	VRAM	VRAM	DRAM	VRAM
Minimum display memory	512K	1MB	512K	512K	1MB
Maximum display memory	1MB	1MB	1MB	1MB	1MB
Rated speed (nanoseconds)	100	100	100	80	80
DISPLAY CHARACTERISTICS					
Maximum addressable resolution (pixels)	2,048 x 1,024	1,024 x 768	2,048 x 2,048	2,048 x 2,048	1,280 x 1,024
Maximum displayable resolution (pixels)	1,280 x 1,024	1,024 x 768	1,024 x 768	1,024 x 768	1,280 x 1,024
Maximum displayable text (columns by rows)	132 x 44	132 x 44	132 x 44	132 x 44	132 x 44
High-color RAMDAC installed	None	None	None	None	Sierra
Other high-color RAMDAC available	Sierra	None	None	None	None
Number of colors simultaneously displayable at 800 x 600 pixels	256	256	256	256	256
8514/A register-level compatible	❑	❑	■	■	❑
VIDEO STANDARDS					
1,280 x 1,024	■	❑	■	■	❑
1,280 x 960	■	❑	❑	❑	■
1,024 x 768 (noninterlaced)	■	■	■	■	■
1,024 x 768 (interlaced)	■	■	■	■	❑
800 x 600 (Super VGA)	■	■	■	■	■
640 x 480 (VGA)	■	■	■	■	■
CONNECTOR SUPPORT					
15-pin mini D-sub	■	■	■	■	■
Other	VESA feature connector	None	Mouse port	Mouse port	None

N/A—Not applicable: ATI Technologies does not catalog its version numbers by date.
AMI—American Megatrends Inc., C&T—Chips and Technologies Inc.

Diamond Stealth VRAM	Genoa WindowsVGA	Glad UltraView	Hornet Rapix I	Orchid Fahrenheit 1280°	Pixel Turbo Windows Accelerator	Portacom Eclipse II	STB Wind X
$445	$495	$245	$199	$449	$390	$325	$499
S3 86C911	S3 86C911	Glad Systems UV6000	Weitek W5086	S3 86C911	S3 86C911	S3 86C911	S3 86C911
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	⌟	■	■	■	■
■	■	■	⌟	■	■	■	■
■	■	■	⌟	■	■	■	■
■	■	⌟	⌟	■	■	■	■
None	None	None	None	None	None	None	None
Diamond	AMI	Glad Systems	Weitek	Orchid	Pixel	AMI	STB
1.0	1.5	16-0 0001	2.00	1 2	2 0	1 5	1.0
11 22 91	9 01 91	5/8/91	11/12/91	9 18 91	10 10 91	9/01/91	10/16/91
ROM BIOS	Proprietary drivers	ROM BIOS	ROM BIOS	Proprietary drivers	Proprietary drivers	Proprietary drivers	Proprietary drivers
S3	S3	Glad Systems	Hornet	S3	S3	S3	S3
VRAM	VRAM	DRAM	DRAM	VRAM	VRAM	VRAM	VRAM
1MB	1MB	512K	512K	512K	512K	1MB	1MB
1MB	1MB	2MB	512K	1MB	1MB	1MB	1MB
85	80	80	100	80	80	80	80
1,280 x 1,024	2,048 x 1,024	1,024 x 768	800 x 600	2,048 x 1,024	2,048 x 1,024	2,048 x 1,024	1,280 x 1,024
1,280 x 1,024	1,280 x 1,024	1,024 x 768	800 x 600	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,024 x 768
132 x 43	132 x 43	132 x 60	80 x 24	132 x 44	132 x 43	132 x 60	132 x 44
Sierra	Sierra	None	None	Sierra	None	None	None
None	None	None	None	None	Sierra	Sierra	None
256	256	256	256	256	256	256	262 144
⌟	⌟	⌟	⌟	⌟	⌟	⌟	⌟
■	■	■	⌟	■	■	■	■
■	■	⌟	⌟	■	■	■	■
■	■	■	⌟	■	■	■	■
■	■	■	⌟	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
VESA feature connector	None	None	None	VESA feature connector	None	None	Mouse port

CONTINUES

figuration—with 1MB of 80-nanosecond VRAM—the WindowsVGA comes standard with a DAC at a retail price of $495 or, as with our evaluation unit, with the Sierra HiColor RAMDAC. Genoa reports early street prices of about $375 for the Sierra-equipped version.

The Genoa offering gives you the strain-saving 72-Hz vertical refresh rate at 640 by 480 with 256 colors and at all 800-by-600 resolutions. Genoa uses Version 1.5 of the S3-supplied BIOS, which does not fully implement VBE compatibility. Proprietary drivers allow users access to VESA-compliant refresh rates in both 800-by-600 and 1,024-by-768 modes.

Available display modes go all the way up to 1,280 by 1,024 with 16 colors (though not under Windows). Performance on our VGA tests hovered around the low-middle range, but in 16-color mode on our text-intensive applications Windows tests, the Genoa ran a fast second to the Diamond card.

In 256-color mode on all our Windows tests, its performance was also impressive. Driver support is extensive. Our evaluation unit came with S3-written drivers for *AutoCAD*, *CADvance*, *Generic CADD*, *Lotus 1-2-3 2.x*, Microsoft Windows 3.0, *Microsoft Word 5.0*, *Microstation*, and *WordPerfect 5.1*.

DRAWBACKS AND HIGHLIGHTS

Unlike the Orchid offering, the Genoa Windows-VGA currently offers no separate access via the Windows driver to 16- and 256-color modes at Super VGA and 1,024-by-768 resolution. To force the board to 16 colors, you'll have to execute the included 4PLANE utility manually or insert it in a batch file. Genoa runs a 24-hour BBS to make future drivers and update information available to users.

The Genoa offering also lacks the generous documentation and automatic driver installation routine of its slickest competition. Admittedly, Genoa has done a better job with only a four-page manual than some vendors do with ten times as much information, and READ.ME files help fill in some of the gaps, but one tends to expect more for a list price of close to $500.

Particular strengths of the FCC Class B–certified WindowsVGA include its pass-through edge connector and the Sync utility that allows you to override the scan frequencies set by the board's DIP switches, which are mercifully located along the board's back bracket. Another plus of Genoa's card is its Safescan within Windows. If your monitor has an overscan feature, for instance, this will allow you to eliminate the black border of the screen in Windows by adjusting overscan to extend just past the screen's visible edges.

Technical support is available weekdays from 8 A.M. to 4 P.M. (P.S.T.). The support is free, but it's a toll call. The board comes with a one-year warranty on parts and labor.

Genoa's video accelerator ran smoothly throughout testing and seems to be a solid S3-based offering. As with Orchid and

FACT FILE

Genoa WindowsVGA
Genoa Systems Corp., 75 E. Trimble Rd., San Jose, CA 95131; 408-432-9090.
List Price: $495
Requires: Fixed-frequency analog VGA monitor for standard modes; multifrequency analog monitors supporting refresh rates to 72 Hz and resolutions as high as 1,280 by 1,024 for all extended and enhanced modes.
In Short: This solid S3-based offering falls a bit short on documentation but compares favorably with its competition, primarily thanks to its pass-through edge connector, Safescan utility, and convenient access to future drivers through Genoa's BBS. In 16-color mode on our text-intensive Windows tests and in 256-color mode on all our Windows tests, the Genoa WindowsVGA offered some of the better scores we saw

CIRCLE 488 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

■—Yes ❑—No	Actix GraphicsEngine Display Accelerator	Artist Graphics WinSprint 100	ATI Graphics Ultra	ATI Graphics Vantage	CSS Maxgraphics/16
SOFTWARE DRIVERS					
AutoCAD	■	■	■	■	■
GEM	❑	■	■	■	❑
Lotus 1-2-3	■	■	■	■	■
Microsoft Windows 3.0	■	■	■	■	■
OS/2 Presentation Manager	❑	■	■	■	❑
Ventura Publisher	❑	■	■	■	❑
Other drivers	*Actix Screen Utilities, CADkey, CADvance, Generic CADD, Microsoft Word, Microstation, VersaCAD, WordPerfect*	*CADkey CADvance, Generic CADD, Microsoft Word, VersaCAD, WordPerfect, WordStar, XWindow*	*AutoCAD AutoShade, CADkey, Lotus Symphony, Microstation, 3D-Studio*	*AutoCAD AutoShade, CADkey, Lotus Symphony, Microstation, 3D-Studio*	None

other well-established vendors, you also buy with the assurance that free driver updates will be available via the company's 24-hour BBS. Though it comes at a premium when compared with some of the competition's prices, the Genoa WindowsVGA is worth a closer look.

GLAD SYSTEMS INC.

Glad UltraView

by Winn L. Rosch

With a unique video accelerator and an intriguingly low price, the UltraView from Glad Systems should be in a class by itself. Test the board or try to get technical support, and you'll know which class: remedial education.

The centerpiece of the UltraView is a UV6000 video accelerator (labeled GSI and made by IIT). The accelerator is used exclusively by Glad Systems, a wholly owned subsidiary of Supercom (a $120 million, eight-year-old system board manufacturer). The chip is connected to a standard VGA RAMDAC and 1MB or 2MB of 80-nanosecond DRAM. The UltraView lists for $245 as tested (with 1MB), or $295 (with 2MB).

Other than memory, don't expect to enhance the big (11.5 inches long), old-technology (pin-in-hole) UltraView. It sports neither a VGA nor VESA feature connector nor does it support a Sierra HiColor RAMDAC or other enhanced RAMDAC.

Setup is confounded by a deceptively straightforward manual that fails to document features or functions. Only one switch of the board's six-switch bank is covered. As it turned out, the reason for this is because the other five switches are completely inactive: They are leftovers from a previous design! It would have been helpful to have that at least noted in the manual.

Technical support for the UltraView was poor: The first technician we contacted had never heard of it.

FACT FILE

Glad UltraView
Glad Systems Inc., 404 South Abbott Ave., Milpitas, CA 95035; 408-456-9069.
List Price: $245
Requires: VGA monitor or better.
In Short: The only display adapter based on IIT's UV6000 graphics accelerator, the Glad UltraView is marred by poor performance, old technology, sketchy documentation, and elusive support.

CIRCLE 489 ON READER SERVICE CARD

During boot-up, the 1MB test board registered only 512K of RAM, which the company reported as normal. At 800-by-600 resolution, the 256-color Windows driver failed to load through setup, and no 256-color *AutoCAD* driver was available. Even in its 16-color mode, however, the UltraView delivered dismal performance on our Windows tests, often delivering less than 20 percent of the leaders' scores.

Worse was technical support. The first technician we contacted had never heard of the UltraView. The company says it offers toll-free technical support weekdays from 9 A.M. to 5 P.M. (P.S.T.), but in our experience, it was only after two days of telephone calls that answers—not necessarily helpful ones—became available. No BBS is available. The warranty is

Diamond Stealth VRAM	Genoa WindowsVGA	Glad UltraView	Hornet Rapix I	Orchid Fahrenheit 1280°	Pixel Turbo Windows Accelerator	Portacom Eclipse II	STB Wind X
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
AutoShade, CADkey, CADvance, DataCAD, Generic CADD, Microsoft Word, Microstation, 3D-Studio, VersaCAD, WordPerfect	*AutoCAD CADvance, Generic CADD, Genoa Utilities, Microsoft Word, Microstation, WordPerfect*	*AutoShade, CADkey, Framework II and III, Lotus Symphony, P-CAD, VersaCAD Designer, VersaCAD 386 WordPerfect, WordStar*	*Microsoft Word, WordPerfect*	*CADkey, CADvance, DataCAD, Generic CADD, Microsoft Word, Microstation, VersaCAD, WordPerfect*	*CADvance Generic CADD Microsoft Word, Microstation WordPerfect*	*AutoShade, AutoSketch, CADkey, CADvance, Generic CADD, Intergraph Microstation Lotus Symphony Microsoft Word, Versa-CAD 386 WordPerfect*	*CADvance, Generic CADD, Microsoft Word, WordPerfect*

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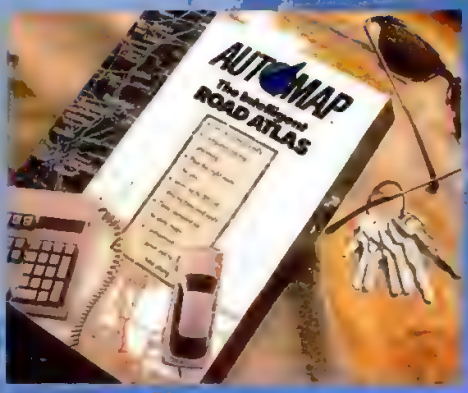

AUTOMAP

AUTOMAP helps you to find the fastest, most scenic, or the most convenient route for your trip-whether for business or pleasure. It's fast fun and informative with hundreds of up-to-date, color maps right on your computer screen. It searches its database of nearly 400,000 miles of roads to find the best route for your requirements. It even lists alternate routes. AUTOMAP's driving instructions list all the roads you'll be travelling, exactly how far to go, exactly where to turn and even the signs to look for. These maps and directions can be printed out to refer to as you need them.
Publisher: AUTOMAP, Inc. BS5224

$59

PC Speakers

PC Speakers provide high quality stereo sound from your PC. If you're working with MIDI synthesizers, CD-ROMs, interactive videodiscs, or voice synthesis, you'll appreciate these compact, full-range speakers. Frequency response is 75Hz to18kHz, and they have internal amplifiers (10 watts/channel), plus volume and bass controls. PC Speakers are magnetically shielded to avoid distorting the image on your monitor. Speakers mount easily to the sides of any monitor.
Manufacturer: Persona Technologies EX2060

$179

DacEasy Light

Designed for people who don't know much about accounting, but who still need to control and organize their financial affairs. It's also great for sole proprietorship accounting and offers conveniences, such as bank statement reconciliation and check writing. With its Balance Sheets and Income statements, you'll always know what the bottom line is. **Publisher: DacEasy, Inc. FN0034 $40**

DacEasy Accounting 4.2

This powerful new version of DacEasy Accounting is packed with new customer requested features, to help you invoice customers, track inventory, monitor spending, cut purchase orders, build budgets, create custom management reports and graphs, provide an audit trail, and more. Installation and set-up are easy and fast. **Publisher: DacEasy, Inc. FN0014**

$95

PerFORM Designer & Filler 2.1

Processing forms can cost businesses millions of dollars, and now there is a solution to reduce these major expenses. PerFORM Designer & Filler, the award winning form processing software package, automates form management by using MS-DOS computers. Recently chosen Editor's Choice by PC Magazine and Best Buy by PC World, PerFORM lets you design, fill-in and print professional looking business forms in an easy to use WYSIWYG format. Includes over 100 sample forms. **Publisher: Delrina Technology BS0853/5**

$90

★PackRat 4.0

PackRat is a powerful, intuitive personal information manager (PIM) that flexibly handles your phone book, calendar, to-do's, hard disk files, projects, autodialing, reminders, finances, time management, free-form notes and more. New Action Buttons and customizable SmartButtons make PackRat work the way you work. Store multiple addresses and phone numbers and extensive notes on your contracts. Seamlessly exchange information with Word for Windows, Ami Pro and Excel. PC Magazine's Editor's Choice. Also available, ***PackRat 4.0 for Networks*** **BS2934 $429 Publisher: Polaris BS2894**

$259

TaxTutor Plus

TaxTutor Plus is a tax guide for maximum tax savings and a support tool for people working with any tax forms package. It provides clear line by line explanations and over a hundred tax savings examples. Learn how to make the tax laws work to your advantage.
Publisher: Softstream

TurboTax 9.0 for DOS

TurboTax handles the difficult, tedious parts of preparing your tax returns, while also giving you the expert help you need to complete your return correctly. It allows you to easily explore "what if" tax planning scenarios for both 1991 and 1992 returns, import data from Quicken and other financial packages, and checks your return for items that might trigger an audit. **Publisher: ChipSoft**

TaxTutor Plus, TurboTax 9.0 for DOS Bundle FN0210

$99

NEW

PhotoFinish

Now with PhotoFinish add real-life drama to all your documents and presentations. PhotoFinish combines impressive painting and powerful retouching capabilities into one easy-to-use Windows image processing program. Combine, alter and enhance your photos for stunning results. Includes precise stitching and de-skewing capabilities for hand scanners. Print life-size posters or import finished images into your favorite Windows word processing, desktop publishing or presentation program to make picture-perfect slides, newsletters, brochures and more. **Publisher: ZSoft Corporation GR5094**

$119

★CorelDraw! 2.0

CorelDraw! 2.0 is the PC graphics software for everyone. It's fun and it's powerful, and the winner of over 40 international first place awards! CorelDraw! gives you incredible type control, superb drawing power, and stunning special effects in a value-packed program. It comes with over 150 fully scalable outline fonts (which can be converted for use with Adobe Type Manager), over 4000 clipart images and symbols; dozens of fill patterns, dotted and dashed line styles, and Arrowheads; 31 import/export filters; a free Pantone license; and free utility programs - CorelTRACE, WFNBOSS, and Mosaic. Windows 3.0 or OS/2 required. Also available on CD ROM. **Publisher: Corel Systems GR0543/5**

$369

CIRCLE 225 ON READER SERVICE CARD

Leading Edge 386/SX 16MHz VGA Complete Color System

Put the Leading Edge VGA Color System to work in your home or office

This fast, Windows 3.0-capable computer, based on a 16 MHz 80386SX chip, comes with 1 MB of RAM, expandable up to 16 MB. It has a 14-inch color VGA monitor, and the controller card emulates VGA, EGA, CGA, MDA, and Hercules. Store your files on the 40 MB hard disk included, or use the 1.2 MB 5.25-inch and 1.44 MB 3.5-inch floppy disk

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MoreFonts

MoreFonts type adds style and excitement to WordPerfect Microsoft Word, Microsoft Works and Windows applications. 14 included typefaces may be combined with outlines patterns, shadows and backgrounds to create over 50,000 custom type styles. Select from thousands of fonts, sized instantly from two to 2,000 points and print without leaving your application. Laser, inkjet or dot matrix printers, produce crisp legible text every time. Includes both DOS and Windows versions. Special Bonus of 14 additional typefaces FREE.

Publisher: MicroLogic Software
GR1444

$79

★Windows Draw!

Fun, Fast & Friendly. If you have Windows, you need Windows Draw! No other Windows graphics package offers such a variety of PC drawing capabilities at a price any user can afford. InfoWorld declared, "this program is a real steal." You'll get 2,600 ClipArt symbols, text along a curve, object blend, and compatibility through 30 import/export filters including PageMaker 4.0, Word for Windows and WordPerfect. If you need an answer, just hit F1 and context-sensitive help will instantly deliver or you can call for 24 hour hotline support. Performance and price-Windows Draw! delivers the best of both. **Publisher: Micrografx, Inc.**
GR2853/5

$105

PC-Kwik Power Pak 2.1

Multisoft Corporation's PC-Kwik Power Pak offers an inexpensive approach to increasing your computer's speed by 3 to 9 times. Speed up your disk drives, screen, keyboard, printers, and other software. Includes a disk cache, screen and keyboard accelerators, screen blanker, print spooler, RAM disk, and command-line editor. See significant speed improvements on MS-DOS, DR DOS, Windows 3.0, DESQview, WordPerfect, Lotus 1-2-3, dBASE, Excel, Page Maker, and many others.

Publisher: Multisoft Corporation
UT0554

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GR2833/5	★Windows Draw!	105
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dBFast

dBFast is the complete, stand-alone database and development language for Microsoft Windows 3.0. It lets you create powerful graphical database applications quickly and easily under Windows. Unlike other Windows development systems that force you to learn a new language, dBFast allows dBASE, Fox and Clipper developers to use the language they already know with more than 200 extensions and an interactive editor, compiler and linker. Graphical, colorful dBFast will bring new life to all your existing dBASE programs. Liven them up with multiple, movable windows, pull down menus, check boxes, dialog boxes, radio buttons and bitmap pictures.

Publisher: Computer Associates BS5543

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GR3174

$134

DesignCAD 2D

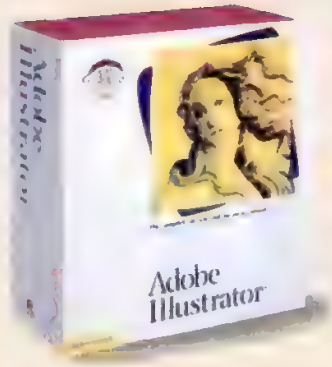
PC Magazine Editor's Choice. DesignCAD has many built-in features that the other CAD packages charge extra for, if they have them at all. DesignCAD is easy to use. It has pull-down menus, an on-screen manual, a tutorial, and single keystroke commands. DesignCAD is flexible! It has a programming language, macros, and user-customized icon menus. DesignCAD is powerful! It has extensive drawing and editing tools, dimensioning, area and center of gravity calculations, and more! **Publisher: American Small Business Co. CA0203**

$175

Design Your Own Home: Architecture, Interiors, Landscape

With Architecture, you can draw professional quality floor plans, side view building plans and structural details in record time, trimming home improvement costs. Architecture automatically calculates all distances, areas, and angles. Interiors is a beautifully simple approach to a more beautiful home. Arrange and rearrange furnishings in seconds. Explore subtle color schemes and variations. Switch from top views to side views. Landscape is easy to use and can help prevent costly mistakes. Position flowers, shrubs, trees, walks, steps, fences, etc. for that look you want. Dozens of sample plans are included with each version. Modify them or create your own. **Publisher: Abracadata** ***Architecture*** **EN2694**
Interiors **EN2764**
Landscape **EN2714**

$49ea



★Adobe Illustrator 4.0

Adobe Illustrator 4.0 for Windows provides a professional illustration solution for the PC environment. This new version of the program allows graphic artists, designers and desktop publishers to create professional-quality illustration and design. This value packed program includes Adobe Type Manager software (ATM), 40 Adobe Type 1 type faces, the Adobe TypeAlign type manipulation program, Adobe Separator color separation software and a generous selection of Adobe patterns, textures symbols, and borders. Other features include: Edit in preview, On-screen text, Resizable toolbox plus enter and edit text directly on screen. With Adobe Illustrator, users can now freely exchange files between Windows, Macintosh and NeXT desktop platforms. **Publisher: Adobe Systems**
GR0214

$309

Bernoulli 90MB Transportable

The new Bernoulli Transportable gives you the convenience of removable media plus lightweight, extremely rugged design. It weighs only 8.5 pounds, and occupies only an 11 by 11 inch space on your desk. It's rugged enough to withstand 1000 Gs of force (equivalent to an eight foot drop). High capacity disks store up to 90 MB of data in a removable cartridge format, with 19 ms access time (13 ms effective access time with cache software)
Manufacturer: Iomega DR1970

$799

Lotus Agenda 1.01

Lotus Agenda is your solution to managing people, projects and time. Consolidate and organize information any way you want it. Agenda will automatically arrange the data, so you can understand it better. Then you can extract data as you need it to formulate plans and new ideas. Agenda has the ultimate "To-Do" list. Just dump in your list of things to do and the program will organize, prioritize and categorize them for you. We know you'll love Lotus Agenda 1.01, and if you decide you want the latest version of this great product, you can upgrade to version 2.0 directly through MicroWarehouse for only $75.
Publisher: Lotus
Lotus Upgrade **BS5754 $75**
Lotus Agenda 1.01
BS0344

$49

NETROOM 2.0

Now the PC Magazine Editors' Choice winning memory manager is even better. NETROOM version 2.0 has a fully automated installation program which optimizes your PC's memory configuration. Quantum technology relocates your system's BIOS freeing up an incredible extra 96k worth of high DOS. NETROOM goes even further, creating a Virtual Machine of up to 576K for programs and networks, leaving you with up to 626K free! Only NETROOM provides access to extended or expanded memory above 1Mb and works on 8088-486 PCs, running DOS and Windows. **Publisher: Helix Also available in:** ***4-User*** **BS5304 $91. and** ***10-User*** **BS5314 $185.**

Netroom 2.0 **BS3154**

$59

CIRCLE 225 ON READER SERVICE CARD

VGA PERFORMANCE TESTS

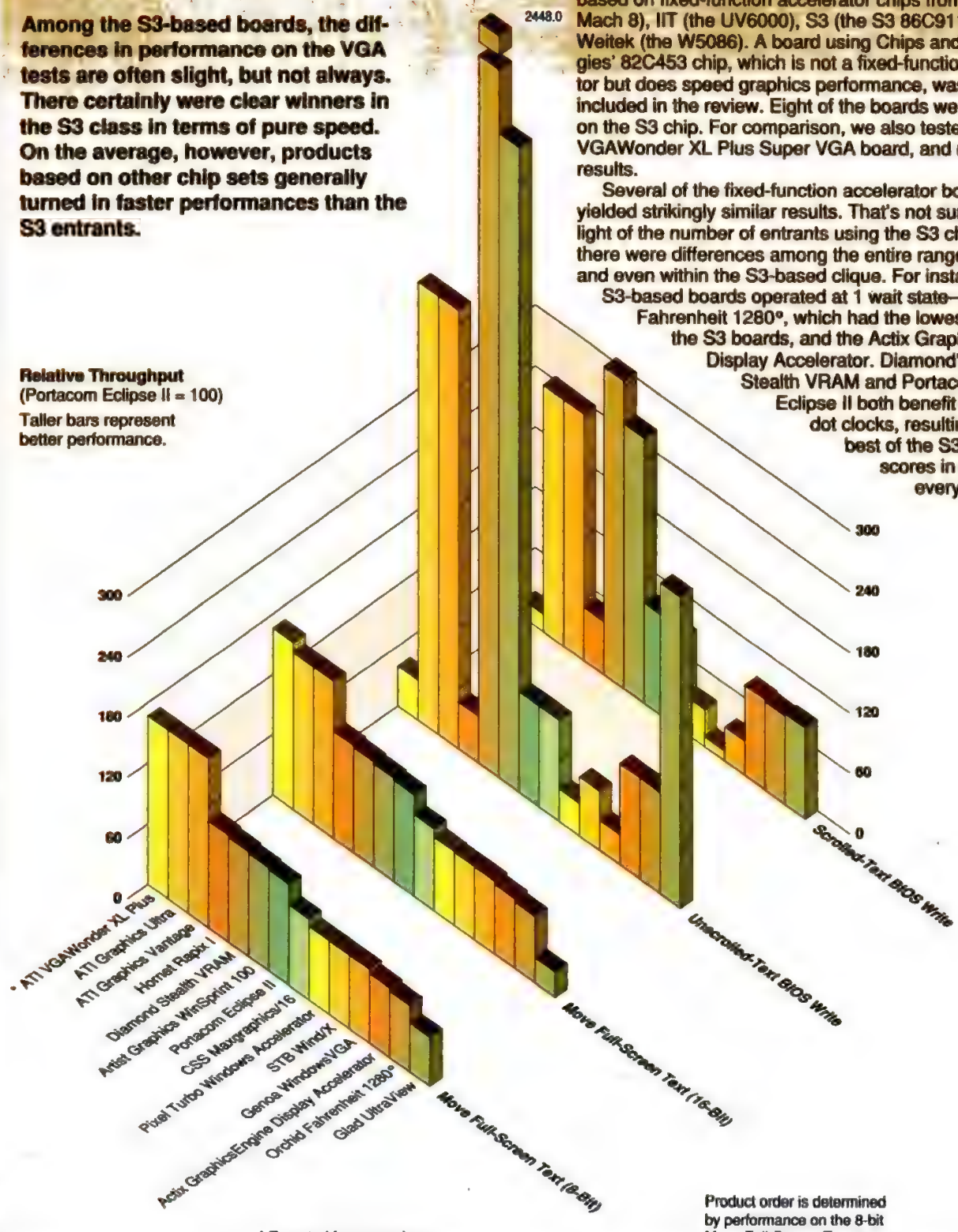
PC LABS

Among the S3-based boards, the differences in performance on the VGA tests are often slight, but not always. There certainly were clear winners in the S3 class in terms of pure speed. On the average, however, products based on other chip sets generally turned in faster performances than the S3 entrants.

WHAT THE NUMBERS MEAN

Twelve of the 13 graphics accelerators we tested were based on fixed-function accelerator chips from ATI (the Mach 8), IIT (the UV6000), S3 (the S3 86C911), and Weitek (the W5086). A board using Chips and Technologies' 82C453 chip, which is not a fixed-function accelerator but does speed graphics performance, was also included in the review. Eight of the boards were based on the S3 chip. For comparison, we also tested the ATI VGAWonder XL Plus Super VGA board, and report the results.

Several of the fixed-function accelerator boards yielded strikingly similar results. That's not surprising, in light of the number of entrants using the S3 chip. But there were differences among the entire range of players and even within the S3-based clique. For instance, two S3-based boards operated at 1 wait state—the Orchid Fahrenheit 1280*, which had the lowest score of the S3 boards, and the Actix GraphicsEngine Display Accelerator. Diamond's S3-based Stealth VRAM and Portacom's Eclipse II both benefit from faster dot clocks, resulting in the best of the S3-class scores in almost every case.



* Reported for comparison.

Product order is determined by performance on the 8-bit Move Full-Screen Text test.

Both the Genoa WindowsVGA and the Pixel Turbo Windows Accelerator, also S3-based boards, suffer from sluggish BIOS Write scores. Across boards of the same processor class, BIOS writes are one of the few operations that can be highly customized and can thus exhibit wide performance swings. The Diamond's extraordinarily strong showing in BIOS writes exemplifies its maker's commitment to speedy text processing and DOS operations, where BIOS efficiency is recognized.

The STB Wind/X's test results put it on a par with the generally lower-end-performing Genoa and Pixel accelerators. The Wind/X, however, performed significantly better than the Genoa and Pixel accelerators on the Unscrolled-Text BIOS Write test (the write test stressed by most vendors) but significantly worse on the Scrolled-Text BIOS Write test. Additionally, on the 320-by-200 Fill and 320-by-200 Screen-to-Screen BitBlt tests, its performance ranged from 52 to 89 percent faster than the Genoa and the Pixel.

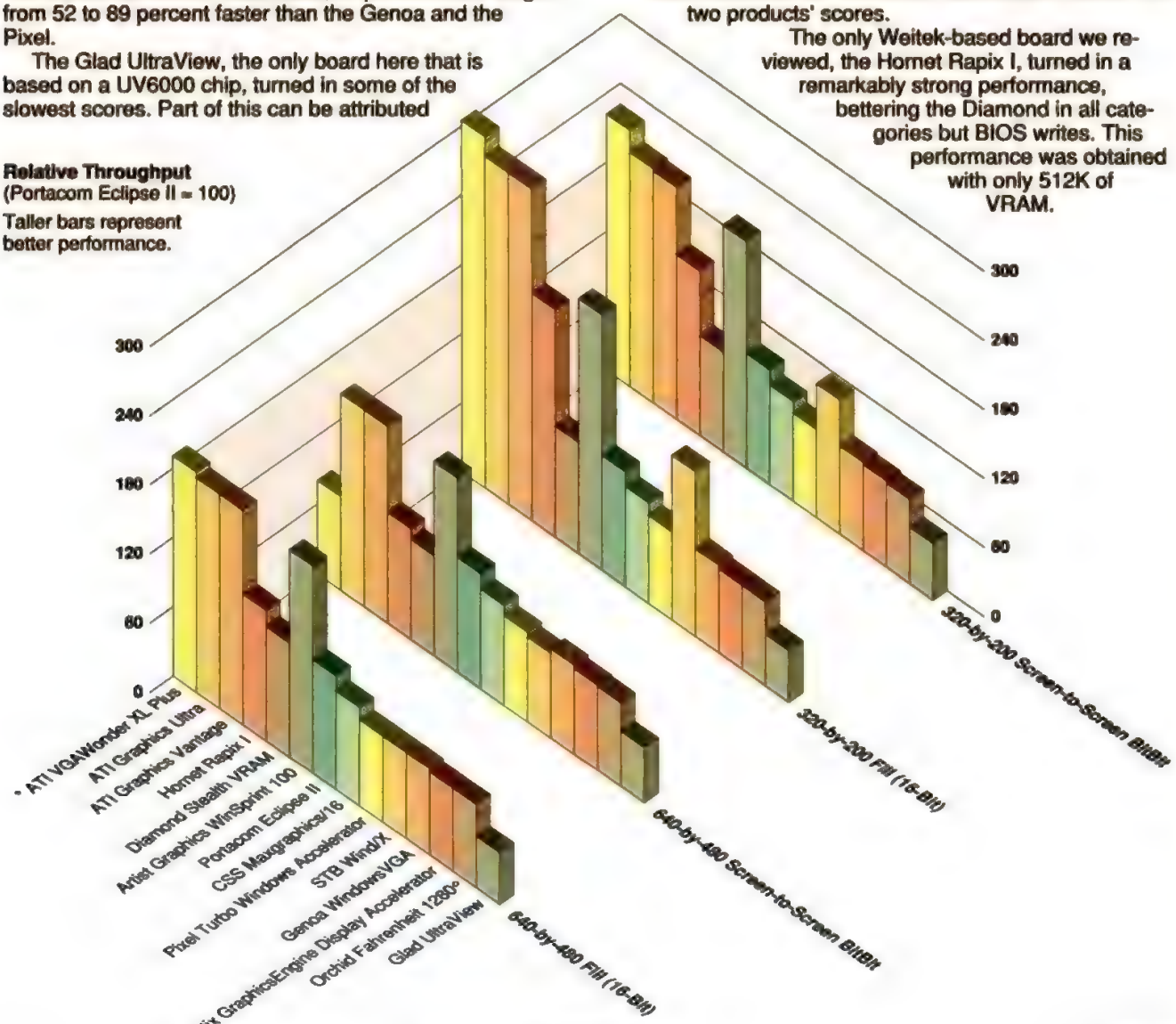
The Glad UltraView, the only board here that is based on a UV6000 chip, turned in some of the slowest scores. Part of this can be attributed to the board's use of slower DRAM in an arena where most of the competitors use fast VRAM. The board defaulted to 8-bit mode (as you can tell by comparing the 8-bit and 16-bit Move Full-Screen Text scores), which handicapped its performance. The 16-bit Move Full-Screen Text score should be roughly twice the 8-bit score, as twice as many bits are being moved.

The Artist Graphics WinSprint 100, using a C&T 82C453 video chip, performed admirably on our VGA tests, excelling on the Screen-to-Screen BitBlt and Fill tests, nearly matching the ATI Mach 8–based boards.

The ATI Graphics Vantage and Graphics Ultra turned in nearly identical scores on our VGA tests; in fact, they were the fastest performers of the 13 cards reviewed. Both boards employ the Mach 8 video chip; the ATI Graphics Vantage uses slower DRAM rather than faster VRAM, which accounts for the minute differences between the two products' scores.

The only Weitek-based board we reviewed, the Hornet Rapix I, turned in a remarkably strong performance, bettering the Diamond in all categories but BIOS writes. This performance was obtained with only 512K of VRAM.

Relative Throughput
(Portacom Eclipse II = 100)
Taller bars represent better performance.



* Reported for comparison.

CONTINUES

VGA PERFORMANCE TESTS

HOW WE TESTED

We tested each board in a Compaq Deskpro 386/25e equipped with 8MB of RAM and a 310MB ESDI hard disk, with the Compaq's built-in VGA disabled. All systems were equipped with Compaq DOS 5.0.

To measure the capabilities of the reviewed boards, PC Magazine Labs tested them in a variety of environments. To examine VGA performance, we used PC Labs' VGA tests, developed in conjunction with Spirit of Performance. Because these tests do not use drivers or other software overhead to exercise the VGA circuitry, they accurately represent the VGA circuitry's performance.

■ The **Move Full-Screen Text (8-Bit)** test writes text to the graphics adapter's screen memory via 8-bit moves. A full-screen move best represents adapter throughput, because there is almost no software overhead involved. We run the test for 10 seconds and report the results in kilocharacters per second (1 kilocharacter = 1,000 characters).

■ The **Move Full-Screen Text (16-Bit)** test writes text to the graphics adapter's screen memory via 16-bit moves. A full-screen move best represents adapter throughput, because there is almost no software overhead involved. We run the test for 10 seconds and report the results in kilocharacters per second.

■ The **Unscrolled-Text BIOS Write** test writes text to the screen via interrupt 10h BIOS calls. After the program fills the screen with text, the cursor moves back to the top of the screen and repeats the procedure. This test measures the video BIOS's efficiency. We run the test for 10 seconds and report the results in kilocharacters per second.

■ The **Scrolled-Text BIOS Write** test writes text to the screen via interrupt 10h BIOS calls. After the program fills the screen with text, each successive text line is teletyped to the bottom of the screen, and a line of text at the top is erased. This test measures forced-scrolling text performance loss and examines the efficiency of the board's video BIOS. We run the test for 10 seconds and report the results in kilocharacters per second.

■ The **640-by-480 Fill (16-Bit)** test fills the video memory with color information via VGA write mode 0 (a common write mode used by many software programs). This test measures the graphics adapter's throughput in graphics mode. We run the test for 10 seconds and report the results in megapixels per second (1 megapixel = 1,000,000 pixels).

■ The **640-by-480 Screen-to-Screen BitBlt** test divides video display memory into four sections. The first three sections contain different-colored fill patterns. This test measures the graphics adapter's performance when it moves pixels from these three sections to the fourth; it minimizes the effects of the system bus. We run the test for 10 seconds and report the results in megapixels per second.

■ The **320-by-200 Fill (16-Bit)** test fills the video memory with color information utilizing the 256-color VGA mode at 320-by-200 resolution. This test predicts 256-color Super VGA performance. We run the test for 10 seconds and report the results in megapixels per second.

■ The **320-by-200 Screen-to-Screen BitBlt** test divides video display memory into four sections. The first three sections contain different-colored fill patterns. This test measures the graphics adapter's performance when moving pixels from these three sections to the fourth. It also predicts the graphics adapter's performance in 256-color Super VGA mode while minimizing the effects of the system bus. We run the test for 10 seconds and report the results in megapixels per second.

	Test Scores (kilocharacters per second)				**Test Scores** (megapixels per second)			
	Move Full-Screen Text (8-Bit)	**Move Full-Screen Text (16-Bit)**	**Unscrolled-Text BIOS Write**	**Scrolled-Text BIOS Write**	**640-by-480 Fill (16-Bit)**	**640-by-480 Screen-to-Screen BitBlt**	**320-by-200 Fill (16-Bit)**	**320-by-200 Screen-to-Screen BitBlt**
*** ATI VGAWonder XL Plus**	1,213.49	2,379.15	3.80	1.19	25.20	4.86	5.06	1.66
ATI Graphics Ultra	1,206.96	2,234.72	41.49	16.81	24.58	10.23	4.78	1.52
ATI Graphics Vantage	1,206.77	2,233.56	41.49	16.81	24.55	10.23	4.78	1.51
Hornet Rapix I	769.04	1,522.53	4.53	3.68	15.12	5.74	3.29	1.07
Diamond Stealth VRAM	753.87	1,489.11	233.75	21.01	13.25	5.22	1.61	0.65
Artist Graphics WinSprint 100	737.93	1,458.76	60.89	18.11	23.94	10.09	3.68	1.48
Portacom Eclipse II	723.91	1,433.98	9.55	6.89	13.21	5.98	1.66	0.75
CSS Maxgraphics/16	576.21	1,160.09	9.55	6.50	11.55	5.23	1.45	0.65
Pixel Turbo Windows Accelerator	530.49	1,040.05	3.10	2.55	10.02	4.69	1.26	0.58
STB Wind/X	528.76	1,036.40	5.51	0.72	10.08	4.40	2.38	0.88
Genoa WindowsVGA	524.92	1,031.22	2.87	2.36	10.05	4.68	1.26	0.58
Actix GraphicsEngine Display Accelerator	499.76	986.08	9.55	6.20	9.62	4.48	1.21	0.56
Orchid Fahrenheit 1280*	478.25	948.24	9.55	6.07	9.62	4.40	1.21	0.55
Glad UltraView	354.17	354.37	29.42	6.17	5.90	2.92	0.74	0.37

* Reported for comparison.

ENDS

one year on parts and labor.

The only reason to buy the Glad UltraView would be its low list price. Its street price is irrelevant: If you find the board on the street, leave it there.

HORNET TECHNOLOGY U.S.A. CORP.

Hornet Rapix I

by Kellyn Betts

Powered by a VBE-compatible Weitek W5086 graphics accelerator chip, the $199 Hornet Rapix I comes with only 512K of DRAM—the maximum the Weitek chip currently supports. This memory limitation prohibits the Rapix I from displaying more than 800-by-600 resolution. Worse, the board delivered some of the poorest performance we saw on our Windows tests.

At the time of our testing, Hornet had no Weitek driver for Windows at 800-by-600 resolution in 256 colors. Because of this, we were unable to test this mode even though the board supports it. On our 16-color Windows tests, the test results were poor; the Hornet's performance indexes were only slightly better than those of the Glad UltraView. The one real bright spot was the Rapix I's performance on our VGA tests, where it turned in remarkably strong scores.

Only six high-resolution drivers came with the Rapix I, but the polish of the *AutoCAD* display-list driver's installation program made it notable. Among its few redeeming features, the board was easy to set up, comes with a reasonable manual, and includes a one-year warranty on parts and labor.

Hornet Technology runs a technical support BBS (714-572-3728). Free, but not toll-free, technical support is available via phone from 7 A.M. to 6 P.M. weekdays (P.S.T.).

The Rapix I represents Hornet's first attempt to manufacture anything besides motherboards under its own name. By the time you read this, the $499 Rapix II, which will feature 512K of VRAM, should be available. Let's hope it lives up to the performance standards of its competition rather than its sibling.

FACT FILE

Hornet Rapix I
Hornet Technology U.S.A. Corp., 330 E. Orangethorpe Ave., Suite E, Placentia, CA 92670; 714-528-9998, 714-572-3781.
List Price: $199.
Requires: VGA monitor or better.
In Short: The only real reason to plunk down $199 for the Hornet Rapix I is if you're going to use it as a VGA card. The 512K-maximum, Weitek accelerator–based card's performance just isn't up to the level of its accelerated peers.

CIRCLE 490 ON READER SERVICE CARD

ORCHID TECHNOLOGY

Orchid Fahrenheit 1280°

by Mitt Jones

Orchid Technology distinguished itself in September as the first vendor to begin shipping a video card—the Orchid Fahrenheit 1280°—based on the S3's 86C911 accelerator chip. Thus far, Orchid appears to have made relatively good use of its lead. Despite a few remaining rough edges, our $449 evaluation unit, which came with a full megabyte of 80-nanosecond VRAM and a Sierra HiColor RAMDAC, ranked among the more full-featured and mature of the S3-based offerings reviewed here.

Orchid also offers the Fahrenheit 1280° in a $399, 512K version, which the company reports can be had for a discounted price of as low as $250. The 1MB version, which should sell on the street for around $275, adds a 256-color mode at 1,024 by 768 and 16-color interlaced modes at 1,024 by 960 in Windows and 1,280 by 1,024 in non-Windows applications. On paper, at least, the additional 512K of VRAM, along with the Sierra HiColor chip, also buys you 32,000 colors at 640 by 480. Unfortunately, because S3 had not yet supplied drivers for that at press time, we were unable to test this feature.

Like most other vendors already shipping an S3 accelerator, Orchid is selling the board with drivers sourced through S3, which explains similarities in both performance and supported software. As with its S3-based peers, for instance, the Fahrenheit 1280° adheres to the 72-Hz refresh rate standard only when a provided driver is active. Of course, you also need a driver to reap the speed improvements of the accelerator.

On the upside, Orchid has managed a trick or two that most of its competition hasn't. Though apparently based on the same code, the Fahrenheit's Windows driver allows separate access to 16- and 256-color modes at resolutions of 800 by 600 and 1,024 by 768. Most other S3-based boards in our roundup require that you execute a utility if you want to force 16-color Super VGA operation in Windows.

NOTABLE ADVANTAGES

As our testing on the Fahrenheit 1280° was drawing to a close, Orchid also delivered a menu-driven driver installation routine, a nicety that most of its competition lacks. Software supported in accelerated modes at press time included not only the requisite Windows 3.0 and *AutoCAD 10* and *11*, but also *CADkey*, *CADvance*, *DataCAD*, *Generic CADD*, *GEM Desktop*, *Lotus 1-2-3 2.x*, *Microsoft Word 5.0*, *Microstation*, *Ventura Publisher*, *VersaCAD*, and *WordPerfect 5.1*. Orchid offers driver updates and other services through its 24-hour BBS. Technical support is available weekdays from 7 A.M. to 5 P.M. (P.S.T.) via a free, but not toll-free, number.

FACT FILE

Orchid Fahrenheit 1280°
Orchid Technology, 45365 Northport Loop W., Fremont, CA 94538; 510-683-0300.
List Price: $449.
Requires: Fixed-frequency analog VGA monitor for standard modes; multifrequency analog monitors supporting refresh rates to 72 Hz and resolutions as high as 1,280 by 1,024 for all extended and enhanced modes.
In Short: The Orchid Fahrenheit 1280° was the first product on the market to use an S3 chip, and its early lead has shown up in advantages such as a Windows driver that allows separate access to 16- and 256-color modes at resolutions of 800 by 600 and 1,024 by 768 and a menu-driven driver installation utility.

CIRCLE 491 ON READER SERVICE CARD

Other advantages of the Fahrenheit 1280° include its generous, well-done documentation, several small errors notwithstanding, its VESA feature connector, its ability to alter scan rates via either back-bracket dip switch settings or an included software utility, and Orchid's four-year warranty on parts and labor. Given the number of adapters not quite ready for market, our evaluation unit's

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CIRCLE 363 ON READER SERVICE CARD

PC LABS

WINDOWS BENCHMARK TESTS

When it comes to Windows, the driver the board uses is the real key to optimum performance. The card with the best results on our VGA hardware tests does not always parley that edge into consistently winning performance on

HOW WE TESTED

To reveal the performance differences of the boards when running Microsoft Windows 3.0, we used a modified version of Release 2.01 of PC Magazine Labs' Graphics Performance Tests for Microsoft Windows (WINBENCH) on the same test-bed we used for the VGA Performance Tests.

Since Windows doesn't supply 800-by-600 drivers, we used proprietary Windows drivers throughout this group of tests. We were unable to get the 16-color Windows driver supplied with the STB board or the 256-color driver supplied with the Glad UltraView to work, and the Hornet Rapix I did not provide 256-color Windows drivers at 800-by-600 resolution. Therefore, it was impossible to run some of the tests on those boards.

DETERMINING FACTORS

Spirit of Performance profiled Windows and Windows application programs to determine their most common operations. These were found to depend on the nature of the application—that is, whether it was predominantly text-intensive (like a word processor or spreadsheet) or by and large graphical (like a presentation graphics package or illustration software). In a text-intensive Windows application, BitBlts make up the majority of operations performed, followed by font scrolling and then random rectangles.

The performance of the graphics boards in BitBlting operation in a text-intensive Windows package is represented by our Source Copy, Source Invert, Pattern Copy, Pattern Invert, Destination Invert, and Whiteness tests. Their performance in font scrolling is represented by the Scroll System Font, Scroll TmsRmn 21-Point Font, Scroll TmsRmn 27-Point Font, Scroll Helvetica 20-Point Font, and Scroll Helvetica 24-Point Font tests.

For graphics-intensive GUI programs—both vector and bitmapped—BitBlts again predominate as the primary function, followed by single-line and polyline draws and then random rectangles. The performance of the graphics boards in BitBlting operation in a graphics-intensive package is represented by four of the same BitBlting tests mentioned above. A board's line-drawing performance is measured by the Single Horizontal, Single Vertical, Single Diagonal, Poly Horizontal, Poly Vertical, and Poly Diagonal tests; its ability to handle random rectangles is measured by the Random Rectangles test.

WEIGHTING PERFORMANCE

We used the information gleaned from profiling Windows applications to create a weighting factor for performance index calculations for both text- and graphics-intensive applications. This weighting factor is applied to each board that we tested and to the ATI VGAWonder XL Plus reference board, and represents the performance as compared with the VGAWonder XL Plus, which is assigned a score of 100.

Using our modified version of WINBENCH 2.01—modified to exercise the selected text and graphics parameters identified through the profiling function—and our standard test-bed, we began our tests. We ran the modified version of WINBENCH for an interval of at least 5 seconds per test. The results are reported in pixels per second for the individual tests that compose the BitBlt operations as well as for the Random Rectangles and Line Draws tests. The Scroll Font test results are reported in characters per second.

In addition to these test scores, a single weighted score appears for each accelerator board for each set of text- and graphics-intensive tests (16- and 256-color). The individual test scores are the calculating factors that determine the weighted score. Please note that the weighted score cannot be characterized as a unit of measurement; it is simply an index of performance. The weighted score provides the best indication of how the product performs in each text-intensive and graphics-intensive mode.

For comparison, we also include individual test scores and weighted performance indexes for a previous Editors' Choice product, the ATI VGAWonder XL Plus, both using its own drivers and, for the 256-color tests, equipped with the *Panacea WinSpeed* drivers. (*Panacea WinSpeed* does not come with drivers for 16 colors.) Also for comparison, we report the results obtained using the TI TMS34020–based Number Nine 9GXi Graphix Coprocessor, a coprocessed board.

WHAT THE NUMBERS MEAN

The structure of the Windows tests provides the ability to rate each board in four areas: its performance on 800-by-600 text-intensive applications in 16- and 256-color modes and its performance on 800-by-600 graphics-intensive applications in 16- and 256-color modes.

Our tests show that in 16-color graphics-intensive applications, a standard Super VGA card (the ATI VGAWonder XL Plus) draws horizontal lines much faster than vertical lines. For VGA and Super VGA cards (as seen with the ATI VGAWonder XL Plus) in 16- and 256-color modes, diagonal line drawing is very slow, because the Windows driver needs to calculate the *x,y* coordinates of every point drawn. By contrast, graphics chips with built-in line-drawing capabilities show little difference in the speed of drawing among horizontal, vertical, and diagonal lines. Interestingly, the ATI VGAWonder XL Plus card, when coupled with the Panacea drivers, doubles the performance index it achieves using its own drivers.

It may surprise you to learn that the coprocessed board did not always achieve the highest performance indexes. The Number Nine 9GXi Graphix Coprocessor did gain some very high scores on a number of individual benchmark tests; its average or low Windows performance indexes result from it not having achieved those high scores on some of the more heavily weighted Windows tests.

our Windows benchmark tests. Since many users looking at video accelerators plan to use them in a Windows environment, the products' scores on these tests merit particular consideration.

As a group, the tests that compose the **Memory-to-Screen BitBlt** suite move a rectangular bitmapped image from system memory to screen memory. Memory-to-screen BitBlts predominate in Windows for both text-intensive and graphics-intensive applications.

BitBlts always use a source, pattern, and destination. System memory is the source and the screen memory is the destination. The pattern bitmap on our tests was an image of the *PC Magazine* logo. Windows and Windows applications use BitBlts to achieve many of the common effects that you see on the screen: displaying the background bitmap, clearing the screen, moving an entire window from place to place, and highlighting an icon, to name a few. WINBENCH performs its BitBlts with 64- by 64-pixel bitmaps. Here is the operation each individual BitBlt score measures, in pixels per second:

- **Source Copy** simply moves the source bitmap from system memory to screen memory.

- **Source Invert** inverts each bit in the bitmap; that is, it replaces all 0 bits with 1 bits (and vice versa) and puts the resulting image on the screen.

- **Pattern Copy** moves the pattern bitmap from system memory to screen memory.

- **Pattern Invert** inverts the pattern bitmap and puts the resulting image on the screen.

- **Destination Invert** inverts the destination bitmap and puts the resulting image on the screen.

- **Whiteness** changes all the bits in the destination image to the current background color.

As a group, the tests that compose the **Scroll Font** suite fill the screen, then scroll through it, horizontally or vertically, and display fonts. Performance in font scrolling is particularly important in text-intensive products, because it occurs almost as often within Windows list boxes as it does in the actual text. That is because users of graphical word processors and spreadsheets tend to require greater use of menus.

The **Scroll System Font, Scroll TmsRmn 21-Point Font, Scroll TmsRmn 27-Point Font, Scroll Helvetica 20-Point Font,** and **Scroll Helvetica 24-Point Font** tests each display text in the entire WINBENCH window (using the particular font) and then scroll half of the screen at a time; that is, each test scrolls the bottom half of the window to the top half and displays new text in the bottom half.

As a group, the tests that compose the **Line Draws** suite measure the graphics boards' ability to draw straight lines. Windows has two ways to draw straight lines. It can simply draw a single straight line from one point on the screen to another; it can also draw polylines, a series of lines connected to one another end to end. Conceptually, polyline drawing is very much like a connect-the-dots puzzle. Windows draws polylines faster than a corresponding series of single straight lines, so applications use polylines whenever possible.

Line drawing is used for borders around Windows and for many other lines that you see on the screen. The **Single Horizontal, Single Vertical, Single Diagonal, Poly Horizontal, Poly Vertical,** and **Poly Diagonal** tests draw horizontal, vertical, and diagonal straight lines to show the differences in hardware- and software-based line-drawing capabilities for various graphics adapters.

The **Random Rectangles** test draws and fills rectangles using a repeatable sequence of randomly chosen *x,y* coordinates, colors, and patterns. Windows draws and fills rectangles with various patterns; it uses patterned rectangle drawings to fill in many areas on the screen. In particular, it chooses patterns to fill areas with dithered colors, which is necessary to represent color shadings when a graphics adapter is capable of displaying only a limited number of colors.

CONTINUES

completed FCC Class B rating also came as a comfort.

As for rough edges, the Fahrenheit 1280° suffers from a few. When set to run at 0 wait states, for instance, our evaluation unit invariably locked up the Compaq Deskpro 386/25e test machine at some point during testing. Fortunately, once we disabled 0-wait-state operation, per an Orchid spokesperson's advice, the board ran smoothly if not quickly (compared with other S3-based boards) on our VGA tests. On our Windows tests, the Fahrenheit had generally midrange performance indexes.

One drawback concerns Orchid's familiar FMODE utility, which allows the user to set the video mode independent of a given driver (though not in lieu of it). The problem here lies with the familiarity itself: Orchid has not updated the utility to allow access to the extended and enhanced video modes via the command line.

Those looking for the best-possible cost in a video accelerator will probably find better prices elsewhere. Given its well-done documentation, Sierra HiColor capability, and the few advantages Orchid's early start with the S3 seem to have gained it, however, the Fahrenheit 1280° should prove an attractive early choice.

PIXEL ENGINEERING INC.

Pixel Turbo Windows Accelerator

by Mitt Jones

As a company that traditionally sells most of its products to other board vendors or systems integrators, Pixel Engineering doesn't put a great deal of emphasis on end-user niceties such as slick, helpful documentation. The strengths of the Pixel Turbo Windows Accelerator, one of the company's first end-user products, come more by way of its low price, seven-year warranty, and Pixel's promise of seven-day-a-week technical support.

The Turbo Windows Accelerator is based on the S3 chip and retails at a fairly high $390 with 1MB of VRAM. Pixel's projected street price of $250 to $300 for the 1MB version places the Turbo Windows Accelerator among the lower-priced S3-based offerings. Those willing to live

WINDOWS BENCHMARK TESTS

TEXT-INTENSIVE APPLICATIONS (800-by-600 Resolution, 16 Colors)

Higher scores represent better performance.	Memory-to-Screen BitBlt Source Copy (pixels per second)	Memory-to-Screen BitBlt Source Invert (pixels per second)	Memory-to-Screen BitBlt Pattern Copy (pixels per second)	Memory-to-Screen BitBlt Pattern Invert (pixels per second)	Memory-to-Screen BitBlt Destination Invert (pixels per second)
Diamond Stealth VRAM	2,044,660	2,045,065	5,071,192	5,071,192	15,204,469
Genoa WindowsVGA	2,030,978	2,032,578	5,102,551	5,163,690	15,472,911
CSS Maxgraphics/16	2,130,477	2,131,749	5,133,008	5,146,320	15,796,620
Actix GraphicsEngine Display Accelerator	2,118,683	2,119,941	5,096,503	5,105,581	15,549,151
Orchid Fahrenheit 1280*	2,045,471	2,023,809	5,121,799	5,124,851	15,479,100
Pixel Turbo Windows Accelerator	1,998,722	1,978,792	5,035,005	4,983,994	15,028,099
Portacom Eclipse II	1,579,387	1,579,387	5,133,008	5,137,097	11,989,030
ATI Graphics Vantage	765,773	757,009	5,133,008	5,134,030	11,016,257
ATI Graphics Ultra	877,774	1,010,913	2,619,802	478,770	4,753,293
Artist Graphics WinSprint 100	1,367,835	763,122	2,833,359	677,432	5,363,514
* ATI VGAWonder XL Plus	1,280,080	735,954	2,758,439	668,933	3,962,660
Hornet Rapix I	877,774	1,010,913	2,619,802	478,770	4,753,293
* Number Nine 9GXi Graphix Coprocessor	3,925,816	1,306,603	1,605,644	1,571,140	14,513,037
Glad UltraView	572,831	572,934	1,644,938	1,664,317	2,673,257
STB Wind/X	N/A	N/A	N/A	N/A	N/A

* Reported for comparison.
N/A—Not applicable: We were unable to get STB's 16-color Windows driver to work.

TEXT-INTENSIVE APPLICATIONS (800-by-600 Resolution, 16 Colors)

All S3-based boards performed rather well in this area. The Diamond Stealth VRAM took lead honors as the fastest board, with an index of 348. On its heels was the Genoa board, with a performance index of 343. The slowest was the Portacom Eclipse II, with a performance index of 292. This board suffered from a rather poor showing on the Destination Invert test, but otherwise it performed well. While its score was the poorest of the S3 boards here, it still had a better showing than any non-S3–based board.

Of the non-S3–based boards, the IIT-based Glad UltraView had the poorest performance index (69). This may be partly attributable to its operating in 8-bit mode. With an index of 92, the Weitek-based Hornet Rapix I was only slightly better than the Glad. The Artist Graphics WinSprint 100 garnered a relatively unimpressive performance index of 108, largely due to its poor Source Invert and Pattern Invert test scores.

Surprisingly low on the performance index scale (compared with the S3-based boards) were the two ATI Mach 8–based boards, the ATI Graphics Ultra and Graphics Vantage, with showings of 169 and 249, respectively. But both ATI offerings beat our coprocessed reference board, the TI TMS34020–based Number Nine 9GXi Graphix Coprocessor with on-board VGA.

GRAPHICS-INTENSIVE APPLICATIONS (800-by-600 Resolution, 16 Colors)

Higher scores represent better performance.	Memory-to-Screen BitBlt Pattern Copy (pixels per second)	Memory-to-Screen BitBlt Pattern Invert (pixels per second)	Memory-to-Screen BitBlt Destination Invert (pixels per second)	Memory-to-Screen BitBlt Whiteness (pixels per second)	Line Draws Single Horizontal (pixels per second)
Portacom Eclipse II	5,133,008	5,137,097	11,989,030	15,734,390	4,133,623
Diamond Stealth VRAM	5,071,192	5,071,192	15,204,469	15,359,785	4,174,438
Genoa WindowsVGA	5,102,551	5,163,690	15,472,911	15,676,481	4,113,514
CSS Maxgraphics/16	5,133,008	5,146,320	15,796,620	16,056,337	4,078,971
Orchid Fahrenheit 1280*	5,121,799	5,124,851	15,479,100	15,860,140	4,103,163
Pixel Turbo Windows Accelerator	5,035,005	4,983,994	15,028,099	15,046,089	4,172,912
Actix GraphicsEngine Display Accelerator	5,096,503	5,105,581	15,549,151	15,781,780	4,113,514
ATI Graphics Vantage	5,133,008	5,134,030	11,016,257	16,345,742	3,602,537
ATI Graphics Ultra	2,619,802	478,770	4,753,293	4,750,449	3,639,755
* Number Nine 9GXi Graphix Coprocessor	1,605,644	1,571,140	14,513,037	15,609,762	3,669,946
Artist Graphics WinSprint 100	2,833,359	677,432	5,363,514	4,298,838	2,639,612
Hornet Rapix I	2,619,802	478,770	4,753,293	4,750,449	2,667,835
* ATI VGAWonder XL Plus	2,758,439	668,933	3,962,660	3,836,674	1,945,628
Glad UltraView	1,644,938	1,664,317	2,673,257	1,665,315	1,591,163
STB Wind/X	N/A	N/A	N/A	N/A	N/A

* Reported for comparison.
N/A—Not applicable: We were unable to get STB's 16-color Windows driver to work.

Memory-to-Screen BitBlt Whiteness (pixels per second)	Scroll System Font (characters per second)	Scroll TmsRmn 21-Point Font (characters per second)	Scroll TmsRmn 27-Point Font (characters per second)	Scroll Helvetica 20-Point Font (characters per second)	Scroll Helvetica 24-Point Font (characters per second)	Weighted Performance Index
15,359,785	79,833	61,152	45,292	63,769	55,729	348
15,676,481	77,505	57,692	41,487	60,870	50,698	343
16,056,337	73,504	50,436	36,127	54,720	43,935	333
15,781,780	72,128	47,900	34,043	51,938	41,826	326
15,860,140	72,153	48,006	34,089	52,484	41,818	324
15,046,089	70,340	46,695	33,069	50,780	40,751	315
15,734,390	62,411	42,539	29,283	46,458	36,071	292
16,345,742	45,969	31,144	21,398	33,400	26,316	249
4,750,449	73,427	49,112	35,556	53,222	42,632	169
4,298,838	28,490	18,695	14,628	20,305	15,975	108
3,836,674	27,137	17,657	14,124	19,732	15,336	100
4,750,449	21,354	13,735	9,718	15,463	11,668	92
15,609,762	77,505	61,309	43,463	61,404	50,356	76
1,665,315	6,979	7,921	4,271	7,462	7,456	69
N/A	N/A	N/A	N/A	N/A	N/A	N/A

GRAPHICS-INTENSIVE APPLICATIONS (800-by-600 Resolution, 16 Colors)

In graphics processing in 16-color mode, some S3-based boards shuffled positions. Here, the Portacom Eclipse II claimed the highest index, 581, owing most of this score to its strength in line drawing. The Diamond Stealth VRAM ran a close second, at 548.

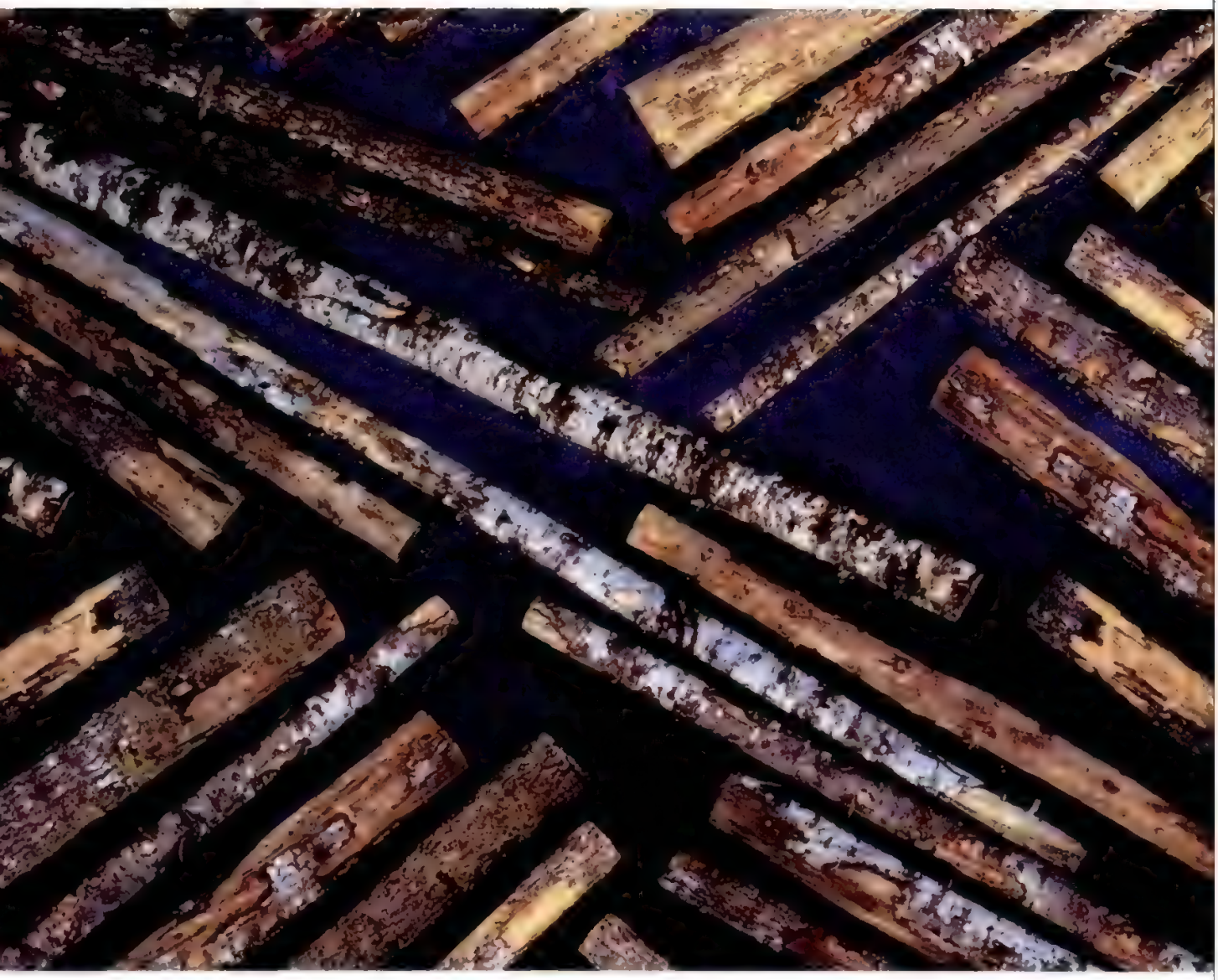
The two ATI boards showed a dramatic improvement over their text-processing scores but still fell behind all of the S3-based boards. In fact, the Graphics Ultra fell dramatically short of all the S3-based boards on the BitBlt tests. The Artist Graphics, Hornet, and Glad boards all showed improvement over their text-intensive 16-color scores but were still no match for the competition.

These test results indicate that graphics processing is emphasized over text-processing applications in driver development for these boards. A comparison of all the WINBENCH test results with PC Magazine Labs' VGA hardware test results will show the importance of good application drivers. The boards that possess the fastest circuitry don't always make the best use of this strength in their drivers.

Line Draws Single Vertical (pixels per second)	Line Draws Single Diagonal (pixels per second)	Line Draws Poly Horizontal (pixels per second)	Line Draws Poly Vertical (pixels per second)	Line Draws Poly Diagonal (pixels per second)	Random Rectangles (pixels per second)	Weighted Performance Index
4,197,463	4,112,772	14,025,065	8,388,879	9,923,621	7,926,126	581
4,197,463	4,112,772	14,609,330	6,390,295	7,886,010	10,950,388	548
4,126,152	4,090,665	13,181,293	5,701,308	7,164,376	10,485,162	528
4,124,861	4,101,689	11,495,468	4,873,276	6,110,487	9,708,740	496
4,072,422	3,999,650	11,482,459	4,167,331	5,348,796	9,599,261	472
4,194,378	4,109,071	10,809,659	4,545,455	5,634,950	9,362,110	472
4,097,272	4,010,892	11,504,157	4,171,486	5,286,558	9,664,014	470
3,869,492	3,878,695	8,735,412	3,770,728	4,833,280	13,381,146	460
3,870,804	3,878,036	13,356,084	6,222,487	7,744,233	17,614,318	408
3,179,843	2,376,269	30,348,953	2,779,451	2,811,749	15,823,782	362
1,326,477	312,963	6,886,878	1,331,297	340,203	6,452,821	123
930,773	775,344	3,069,373	666,497	822,169	4,235,498	110
828,435	224,418	3,922,007	729,876	240,800	5,760,909	100
863,497	602,438	2,716,402	709,115	723,315	1,014,264	90
N/A	N/A	N/A	N/A	N/A	N/A	N/A

CONTINUES

Application backlogs.



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WINDOWS BENCHMARK TESTS

TEXT-INTENSIVE APPLICATIONS (800-by-600 Resolution, 256 Colors)

Higher scores represent better performance.	Memory-to-Screen BitBlt Source Copy (pixels per second)	Memory-to-Screen BitBlt Source Invert (pixels per second)	Memory-to-Screen BitBlt Pattern Copy (pixels per second)	Memory-to-Screen BitBlt Pattern Invert (pixels per second)	Memory-to-Screen BitBlt Destination Invert (pixels per second)
ATI Graphics Ultra	1,675,648	1,653,422	5,147,346	5,157,637	15,819,334
Diamond Stealth VRAM	1,578,131	1,595,807	5,127,907	5,133,008	12,067,905
Portacom Eclipse II	1,595,502	1,579,073	5,138,120	5,145,293	11,733,346
Genoa WindowsVGA	1,445,209	1,445,486	5,066,135	5,134,030	11,108,756
* Number Nine 9GXi Graphix Coprocessor	1,383,462	1,073,947	1,587,902	1,587,902	10,055,117
CSS Maxgraphics/16	1,569,705	1,570,326	5,148,374	5,152,487	9,502,793
ATI Graphics Vantage	1,650,802	1,485,053	5,190,291	5,185,154	11,005,348
Actix GraphicsEngine Display Accelerator	1,552,210	1,552,210	5,143,242	5,155,576	9,340,686
Orchid Fahrenheit 1280*	1,447,150	1,447,428	5,118,750	5,121,799	9,316,531
STB Wind/X	1,581,590	1,582,536	5,164,708	5,164,708	8,600,815
Pixel Turbo Windows Accelerator	1,425,808	1,424,850	5,061,507	5,119,289	8,629,982
Artist Graphics WinSprint 100	2,368,610	538,430	4,203,777	250,173	3,696,849
* ATI VGAWonder XL Plus (with *Panacea WinSpeed*)	2,406,866	1,122,878	2,402,636	1,071,255	1,144,904
* ATI VGAWonder XL Plus	2,395,619	112,916	2,054,021	927,878	616,304
Glad UltraView	N/A†	N/A†	N/A†	N/A†	N/A†
Hornet Rapix I	N/A†	N/A†	N/A†	N/A†	N/A†

* Reported for comparison. N/A†—Not applicable: We were unable to get Glad's 256-color driver to work.
N/A†–Not applicable: Hornet does not provide 256-color Windows drivers at 800-by-600 resolution.

TEXT-INTENSIVE APPLICATIONS (800-by-600 Resolution, 256 Colors)

The speediest board in this area was clearly the ATI Graphics Ultra, excelling at the Memory-to-Screen BitBlt Destination Invert test, which helped the board obtain a performance index of 995. Surprisingly, the ATI Graphics Vantage, which outperformed the Ultra in 16-color text-intensive and graphics-intensive processing, was no match for the Ultra in 256-color mode.

The Diamond Stealth VRAM and Portacom Eclipse II scored a not-so-close second and third, in that order, with performance indexes of 868 and 854, respectively. The Pixel Turbo Windows Accelerator, at 696, and the STB Wind/X, at 711, brought up the rear as the slowest S3-based boards in this area but were still some seven times as fast as the ATI VGAWonder XL Plus reference board. The Artist Graphics WinSprint 100 turned in the lowest performance index, 245, which more than doubled its 16-color-mode score in text-intensive applications but did not measure up to the S3-based boards.

GRAPHICS-INTENSIVE APPLICATIONS (800-by-600 Resolution, 256 Colors)

Higher scores represent better performance.	Memory-to-Screen BitBlt Pattern Copy (pixels per second)	Memory-to-Screen BitBlt Pattern Invert (pixels per second)	Memory-to-Screen BitBlt Destination Invert (pixels per second)	Memory-to-Screen BitBlt Whiteness (pixels per second)	Line Draws Single Horizontal (pixels per second)
ATI Graphics Ultra	5,147,346	5,157,637	15,819,334	16,094,826	3,591,656
Diamond Stealth VRAM	5,127,907	5,133,008	12,067,905	15,869,652	3,917,968
Portacom Eclipse II	5,138,120	5,145,293	11,733,346	15,945,813	3,960,104
Genoa WindowsVGA	5,066,135	5,134,030	11,108,756	15,667,105	4,173,675
CSS Maxgraphics/16	5,148,374	5,152,487	9,502,793	15,863,309	4,113,514
Actix GraphicsEngine Display Accelerator	5,143,242	5,155,576	9,340,686	15,856,972	4,128,391
Orchid Fahrenheit 1280*	5,118,750	5,121,799	9,316,531	15,780,839	4,156,956
Pixel Turbo Windows Accelerator	5,061,507	5,119,289	8,629,982	15,766,186	4,155,442
ATI Graphics Vantage	5,190,291	5,185,154	11,005,348	16,278,641	3,605,951
STB Wind/X	5,164,708	5,164,708	8,600,815	16,177,343	4,115,738
* Number Nine 9GXi Graphix Coprocessor	1,587,902	1,587,902	10,055,117	15,344,480	3,697,765
Artist Graphics WinSprint 100	4,203,777	250,173	3,696,849	4,244,920	1,522,000
* ATI VGAWonder XL Plus (with *Panacea WinSpeed*)	2,402,636	817,891	1,144,904	2,735,086	1,547,377
* ATI VGAWonder XL Plus	2,054,021	927,878	616,304	2,564,656	408,087
Glad UltraView	N/A†	N/A†	N/A†	N/A†	N/A†
Hornet Rapix I	N/A†	N/A†	N/A†	N/A†	N/A†

* Reported for comparison. N/A†—Not applicable: We were unable to get Glad's 256-color driver to work.
N/A†–Not applicable: Hornet does not provide 256-color Windows drivers at 800-by-600 resolution.

Memory-to-Screen BitBlt Whiteness (pixels per second)	Scroll System Font (characters per second)	Scroll TmsRmn 21-Point Font (characters per second)	Scroll TmsRmn 27-Point Font (characters per second)	Scroll Helvetica 20-Point Font (characters per second)	Scroll Helvetica 24-Point Font (characters per second)	Weighted Performance Index
16,094,826	73,209	49,084	35,549	53,121	42,975	995
15,869,652	62,690	43,515	29,646	47,474	36,989	869
15,945,813	62,467	42,532	29,043	46,030	36,078	854
15,667,105	60,034	39,672	26,959	43,597	33,613	809
15,344,480	65,703	50,811	34,447	52,025	41,697	777
15,863,309	52,910	34,261	23,095	37,812	28,687	747
16,278,641	45,849	30,983	21,307	32,558	26,196	734
15,856,972	50,725	32,943	22,292	36,293	27,832	731
15,780,839	50,928	33,079	22,334	36,441	27,934	721
16,177,343	49,391	31,539	21,194	34,820	26,554	711
15,766,186	49,707	31,444	21,490	34,750	26,687	696
4,244,920	14,577	10,501	6,888	10,734	7,846	245
2,735,066	8,434	5,169	3,484	5,770	4,367	209
2,564,656	6,756	4,505	3,073	4,980	3,821	100
N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†
N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†

GRAPHICS-INTENSIVE APPLICATIONS (800-by-600 Resolution, 256 Colors)

In graphics mode at this resolution with this number of colors, we saw little difference in the order of boards, fastest to slowest. With only one exception, however, each board showed improved performance over the text-intensive 256-color results.

The performance of the products on these tests paralleled the 16-color results, where graphics performance was also stressed over text performance.

The ATI Graphics Ultra took top honors, again, with an index of 1,198, followed—this time closely—by the Diamond Stealth VRAM, which had an index of 1,123. The Artist Graphics WinSprint 100, the only board to show an index drop from the text-intensive 256-color results, was again the performance trailer on our tests.

Line Draws Single Vertical (pixels per second)	Line Draws Single Diagonal (pixels per second)	Line Draws Poly Horizontal (pixels per second)	Line Draws Poly Vertical (pixels per second)	Line Draws Poly Diagonal (pixels per second)	Random Rectangles (pixels per second)	Weighted Performance Index
3,798,922	3,801,199	13,327,496	6,211,401	7,740,295	17,948,540	1,198
4,001,753	3,946,413	14,240,269	8,605,119	10,193,264	7,917,579	1,123
3,940,283	3,913,267	14,035,411	8,390,374	9,927,320	7,845,665	1,104
4,162,261	4,106,854	13,168,621	7,857,277	9,304,803	7,551,150	1,057
4,158,470	4,112,772	11,467,320	6,765,847	7,967,196	6,799,415	950
4,192,837	4,105,377	11,341,282	5,971,456	7,098,881	6,678,807	911
4,196,691	4,112,032	11,353,972	5,915,174	7,187,382	6,669,706	911
4,135,120	4,150,155	10,480,031	6,155,355	7,327,171	6,397,533	892
3,901,230	3,797,405	8,705,434	3,772,088	4,821,033	13,059,827	881
4,091,398	4,028,587	10,406,329	6,201,581	7,282,297	6,390,109	881
3,692,741	2,401,767	21,034,551	4,041,731	2,882,030	13,136,939	867
974,018	337,412	2,129,863	1,010,628	384,518	2,752,994	217
623,873	338,734	2,264,207	550,353	386,510	2,976,783	150
442,288	181,001	471,266	356,656	193,945	2,695,387	100
N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†
N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†

ENDS

FACT FILE

Pixel Turbo Windows Accelerator
Pixel Engineering Inc., 40491 Encyclopedia Circle, Fremont, CA 94539; 510-656-1338.
List Price: $390; with Sierra HiColor RAMDAC, $420.
Requires: Fixed-frequency analog VGA monitor for standard modes; multifrequency analog monitors supporting refresh rates to 72 Hz and resolutions as high as 1,280 by 1,024 for all extended and enhanced modes.
In Short: Suffering somewhat from lackluster documentation, this S3-based offering is a little pricey, considering its lower-end performance on our Windows tests, particularly in 256-color mode. A seven-year warranty and a seven-days-a-week technical-support hotline, however, are notable extras.

CIRCLE 492 ON READER SERVICE CARD

with top video modes of 800 by 600 at 256 colors and 1,024 by 768 at 16 colors should be able to find the $360 512K version at street prices as low as $200.

The trade-offs for this low cost are few but notable. As hinted previously, for example, the documentation for the board could be a good bit better. You'll find tables of jumper settings but no jumper location diagrams and no step-by-step hardware instructions. The manual adequately describes installation procedures for the board's numerous drivers, but you'll find no automatic driver installation routine. Experienced users should have no problem with this, but tyros should look elsewhere.

The list price of the Turbo Windows Accelerator goes up to $420 for the 1MB version if you want the 32,000 colors of the Sierra HiColor RAMDAC (which we did not review). By February, Pixel planned to offer the 64,000-color Brooktree or INMOS RAMDAC version at a list price of $430. The Pixel board offerings include neither a pass-through edge connector nor a VESA feature connector.

Another drawback, though one that Pixel claimed to have eliminated by press time, concerns the slot bracket on our early (but shipping) production unit. Faulty mounting of the bracket and the unusually high position of the 15-pin port along the board conspired to make installation difficult. We were able to fit the board into any slot of the Compaq Deskpro 386/25e,

AUTOCAD PERFORMANCE TESTS

The S3 chip was the all-around winner on our *AutoCAD* performance tests. As a group, the boards using this chip bested even the Number Nine 9GXi Graphix Coprocessor—with its TI TMS34020 chip—in all test categories except redraw.

WHAT THE NUMBERS MEAN

As is the case with most applications-based tests, performance depends more on the drivers employed than the hardware. In our comparison of video chip performance in *AutoCAD*, the S3 86C911– based boards outperformed the competition in all categories except redraw, where the Number Nine reference board (with a TI TMS34020 chip) took the lead. Considering that it uses a DLL driver—which should boost its performance in all areas—we were surprised that it took the lead in only one of our five test categories.

Among the products reviewed, the Artist Graphics WinSprint 100 (with a Chips and Technologies 82C453 chip) placed second in regenerations, zoom-ins, and zoom-outs, and third in redraws, largely because of its 32-bit transfers (all the other chips use 16-bit transfers). The ATI Graphics Vantage and Ultra used the ATI Mach 8 chip; they turned in fast redraws and pans but were middle-of-the-pack on the more complex regenerations, zoom-ins, and zoom-outs.

Test Scores (seconds)
Lower scores represent better performance.

	Multiple-Entity Regeneration	Multiple-Entity Redraw	Multiple-Entity Zoom-In	Multiple-Entity Zoom-Out	Multiple-Entity Pan
†Boards using the S3 86C911 chip	12.75	0.39	12.94	6.71	0.19
Artist Graphics WinSprint 100	13.40	0.50	13.58	7.08	0.29
Hornet Rapix I	13.66	2.80	13.82	8.11	2.04
Glad UltraView	13.67	1.46	13.69	7.45	0.83
†ATI Graphics Vantage	14.13	0.42	14.30	7.34	0.17
* ATI VGAWonder XL Plus	14.46	0.74	14.67	7.64	0.28
* Number Nine 9GXi Graphix Coprocessor	15.51	0.32	15.86	8.27	0.28

	Mass-Entity Regeneration	Mass-Entity Redraw	Mass-Entity Zoom-In	Mass-Entity Zoom-Out	Mass-Entity Pan
†Boards using the S3 86C911 chip	8.79	0.27	8.77	4.52	0.20
Artist Graphics WinSprint 100	9.46	0.52	9.34	5.10	0.56
Hornet Rapix I	9.68	2.35	9.55	5.74	2.00
†ATI Graphics Vantage	9.89	0.23	9.76	4.97	0.21
Glad UltraView	10.10	1.67	9.70	6.07	1.57
* ATI VGAWonder XL Plus	10.29	0.64	10.13	5.32	0.65
* Number Nine 9GXi Graphix Coprocessor	10.66	0.24	10.84	5.67	0.28

† Average scores for the eight boards that use this chip.
† The ATI Graphics Ultra had the same results.
* Reported for comparison.

but plugging in the adapter cable required that we remove the plastic molding from the back panel of the system to provide additional clearance. Identical boards (not reviewed) submitted by two Pixel OEM customers—Quickpath and Ground Hog—suffered from the same early manufacturing defect.

The Turbo Windows Accelerator shares a rather frustrating Windows driver design with numerous other products in this roundup. Instead of offering separate Windows drivers for 16- and 256-color modes at resolutions of either 800 by 600 or 1,024 by 768, the Turbo Windows Accelerator offers one 16/256 color driver for each resolution. To force the driver into 16-color mode, an action you may well want to take to keep performance at a maximum, you'll have to execute a provided utility—4PLANE.EXE—either manually or by embedding it in a startup file. (The company reports that it now includes separate access for each driver.)

The Pixel board comes with a healthy list of S3-sourced drivers: *AutoCAD 10 and 11, CADvance, Generic CADD, Lotus 1-2-3 2.x, Microsoft Word 5.0, Microstation,* Windows 3.0, and *WordPerfect 5.1*. The Pixel performed at the lower end of the S3-based offerings on PC Magazine Labs' VGA tests. Its performance indexes on the 256-color Windows test were decidedly on the low end for an S3-based board; its scores on the 16-color tests were slightly more competitive with the other S3 entries.

Along with the other S3-based accelerators in this roundup, our evaluation unit was able to adhere to a 72-Hz refresh rate in 800-by-600 mode only when one of its drivers was active. But Pixel touts its FASTBIOS utility, which claims to speed performance by as much as 35 percent by shadowing video RAM, and the adapter's low chip count as particular strengths of its board.

Technical support is available Monday through Friday from 9 A.M. to 6 P.M. The company also adds Saturday and Sunday hours from 9 A.M. to 12 P.M. (P.S.T.). The call is free, but not toll-free.

The Pixel Turbo Windows Accelerator performed without a glitch during PC Magazine Labs' testing. Provided you can live without a pass-through connector, state-of-the-art documentation, and 24-hour access to driver updates via a BBS, the accelerator's seven-year warranty should help make it an attractive alternative.

The Weitek W5086–based Hornet Rapix I was hampered by its low 512K of video memory, which explains its poor results on some tests. But this board was able to obtain middle-of-the-pack performance on both the zoom-in and zoom-out tests.

The Glad UltraView's IIT UV6000 chip, though running in 8-bit mode, did better than the Weitek, which was running in 16-bit mode, in redraws and pans. Its performance on the other tests was unimpressive.

HOW WE TESTED

We used the same test-bed for the *AutoCAD* tests as for our VGA and WINBENCH tests, with the addition of an Intel 80387 math coprocessor to the Compaq machine. Each board was configured to run at 800-by-600 resolution, in 16 colors. We used each board's proprietary *AutoCAD* drivers, when available.

For comparison, we also tested a board based on the TI TMS34020 coprocessed chip set, the Number Nine 9GXi Graphix Coprocessor, and we report the results. Also for reference, we tested the ATI VGAWonder XL Plus board, which uses the AT1000 chip, and we report its results.

Our *AutoCAD* performance tests measure video performance over several fundamental *AutoCAD* operations, performed on a mass-entity diagram (multiple wireframe views of a single engineering model) and a multiple-entity diagram (multiple wireframe views of single engineering models). Each operation is performed ten times, and the average time is reported in seconds. Because our measurements are in units of time, smaller numbers represent better performance.

Rather than individual results for the S3-based boards, we report the entire group's average score on each test. Most of the boards we reviewed are in this group: the Actix, CSS, Diamond, Genoa, Orchid, Pixel, Portacom, and STB units. Generally, their test scores all fell within a 5 percent range. The only exception was the Diamond Stealth VRAM, whose somewhat slower performance placed it slightly outside that range.

■ The **Mass-Entity** and **Multiple-Entity Regeneration** tests measure the time it takes to perform a regeneration (to completely recalculate all vectors in the image). An image is typically regenerated when it is rescaled or modified.

■ The **Mass-Entity** and **Multiple-Entity Redraw** tests measure the time it takes to refresh an existing image on-screen. This command throws the contents of the memory buffer onto the screen; the image appears faster but is less precise than when a regeneration is performed.

■ The **Mass-Entity** and **Multiple-Entity Zoom-In** tests are the average time required to perform two-, four-, and eight-power magnifications of the image, interspersed with zoom-out commands.

■ The **Mass-Entity** and **Multiple-Entity Zoom-Out** tests are the average time required to perform reductions of the image to one-half, one-quarter, and one-eighth of its size, interspersed with zoom-in commands.

■ The **Mass-Entity** and **Multiple-Entity Pan** moves the image across the screen left, right, up, or down.

PORTACOM TECHNOLOGIES INC.

Portacom Eclipse II

by Winn L. Rosch

Primitive people feared the eclipse. Today, display adapter makers have reason to fear the Eclipse II from Portacom Technologies. Its combination of accelerated graphics performance, optional broad spectrum, and affordable price make it a tough competitor. In fact, the only potential cloud that may obscure your viewing is a complex, one-time setup.

With 1MB of VRAM, the Eclipse II carries a list price of $299; a Sierra HiColor RAMDAC adds only $26 (to $325). The company claims that a 16-bit direct-color DAC with XGA compatibility is available for only $24 more (though we did not receive or test this feature). On the street, you might pay as little as $225 for the standard 1MB board. The 7.5-inch long, XT-height board holds an S3 accelerator, Sierra HiColor RAMDAC, and a soldered-down megabyte of 80-nanosecond VRAM. A standard VGA feature connector is available on the board for future expansion.

The board supports a 70-Hz refresh at 1,024-by-768-pixel resolution. Although

the company uses Version 1.5 of the S3-supplied BIOS, proprietary drivers make this as well as a VESA-compliant 72-Hz refresh rate in 800-by-600 mode possible. Maximum resolution in non-Windows applications is 1,280 by 1,024 pixels (interlaced, in 16 colors), with a 256-color maximum from a 256,000-color palette available at all lower resolutions. This is upped to 32,000 colors with the optional HiColor chip—once those drivers from S3 ship, that is.

All of the Eclipse II's circuitry is crafted from surface-mounted components, except for eight resistor networks, a video connector, and setup jumpers. That's problem one: eight banks with a full 24 jumpers to plague your setup attempts—more than you may want to tangle with.

Problems were also encountered with an early version of the Eclipse II's automatic software setup program (a disk was misidentified), though the board's drivers worked very well when configured manually. Portacom claims to have fixed this problem.

A single driver serves both 16- and 256-color operation under Windows. On our 16-color Windows tests, the Portacom excelled at graphics-intensive applications, but because of a poor showing on the Destination Invert test, it achieved a poor rating on the text-intensive applications performance index.

PC FACT FILE

EDITORS' CHOICE

Portacom Eclipse II
Portacom Technologies Inc., 3235 Kifer Rd. #310, Santa Clara, CA 95051; 408-736-9135.
List Price: $325.
Requires: VGA monitor or better.
In Short: The Portacom Eclipse II is a state-of-the-art, S3-based graphics accelerator with fast 256-color and line-drawing performance. Setup can be complicated because of the multitude of jumpers, but the low price and good performance of this board tip the scales in the board's favor.

CIRCLE 493 ON READER SERVICE CARD

The Eclipse II proved among the top contenders in 256 colors on both text- and graphics-intensive applications Windows tests. It was especially adept at line drawing. Aside from a sluggish BIOS write score, the Portacom went head to head with the Diamond Stealth VRAM on our VGA tests, even besting it in some instances.

Technical support is free weekdays from 8 A.M. to 6 P.M. (P.S.T.), though the call is not toll-free. Additionally, no BBS is available. The board is covered by a five-year warranty on parts and labor. The combination of low price and good performance make the Eclipse II something to watch.

STB SYSTEMS INC.

STB Wind/X

by John R. Quain

When you travel in a fast crowd, it's difficult to distinguish yourself from the rest of the pack. That's the problem faced by the STB Wind/X. Based on the S3 86C911 chip, the Wind/X's performance was mostly average compared with other S3-based adapters. STB's board includes a Logitech bus mouse, but the adapter's $499 price makes it one of the most expensive accelerators in this roundup, especially considering that it doesn't include a Sierra HiColor RAMDAC chip. A 512K version is available for a still pricey $399.

Stocked with 1MB of dual-ported 80-nanosecond VRAM, the half-length 16-bit ISA board doesn't skimp on features. It is able to deliver an ergonomic noninterlaced 72-Hz vertical refresh rate in VGA, Super VGA, and 1,024-by 768-resolutions. In each of those resolutions, the Wind/X can display 256 colors from a palette of 262,144 colors.

There are enough drivers to make most users happy. Supplied software drivers accompanying the Wind/X include *AutoCAD, CADvance, Generic CADD,* Windows 3.0, *WordPerfect,* and a high-resolution text mode for *Lotus 1-2-3* (132 columns by 44 lines).

On the other hand, installing the Wind/X is not a plug-and-play operation. The board uses several jumper settings to make such adjustments as memory speed, refresh rate, and bus mouse support. (A call to technical support revealed some undocumented software switches for resetting the refresh rates.)

Software installation wasn't much simpler. Windows' setup routine did not recognize the Wind/X drivers. It was necessary to copy the driver file to a hard disk (it requires 1.2MB of storage) and decompress the file before Windows would install it. STB support staff indicated that a new manual and setup routine would be released.

PC Magazine Labs' VGA performance test results elicited mostly low-midrange performance from the Wind/X, although its scores on the 320-by-200 Fill and 320-by-200 Screen-to-Screen BitBlt tests were much higher. But on Windows tests at 800-by-600 resolution with 256 colors, the STB board performed slower than most of its S3 brethren. (A Wind/X driver problem that the company could not fix in time prevented us from conducting Windows 16-color tests, and a new Panacea display-list driver for *AutoCAD* was not available in time for use in this review.)

PC FACT FILE

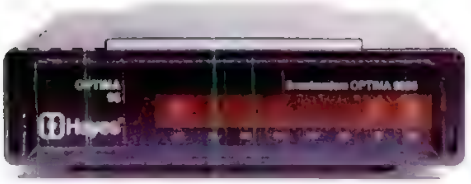
STB Wind/X
STB Systems Inc., 1651 North Glenville, #210, Richardson, TX 75081; 214-234-8750.
List Price: $499.
Requires: VGA monitor or better.
In Short: Another member of the S3 graphics accelerator gang, the Wind/X video adapter includes a Logitech Mouseman bus mouse It's a handy addition, but compared with other S3-controlled boards, the Wind/X's video performance is only average, or a little less than that, in most cases. Some users may also find its jumper settings inconvenient and the price a bit steep.

CIRCLE 494 ON READER SERVICE CARD

Aside from minor nuisances, the Wind/X worked as promised and the bus mouse was an appreciated addition. The board is Microsoft Mouse–compatible, has a selectable IRQ, and offers a zippy improvement over the standard serial pointer. The three-button Logitech Mouseman included with the package is comfortable and the bus mouse will save you an expansion slot.

STB supports the Wind/X with a two-year warranty on parts and labor, a user BBS, and toll-free technical support from 8 A.M. to 6 P.M. (C.S.T.) Monday through Friday. But the adapter lacks a VESA connector, delivers only middling S3 performance, and even with a 20 percent dealer discount, is expensive. ■

Oliver Rist is a staff editor of PC Magazine. *Mitt Jones, Alfred Poor, and Winn L. Rosch are contributing editors of* PC Magazine. *Kellyn Betts and John R. Quain are frequent contributors to* PC Magazine.



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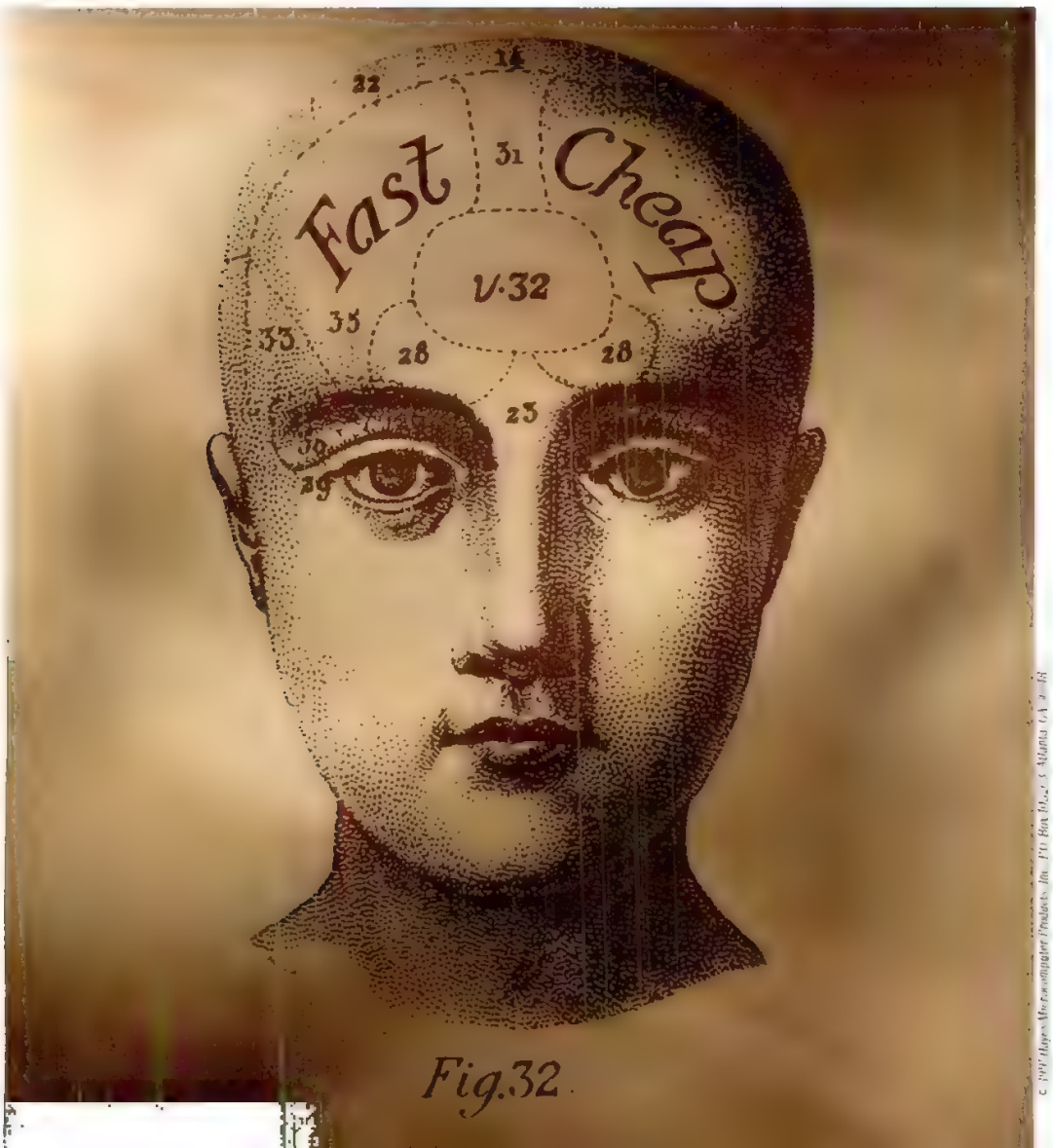

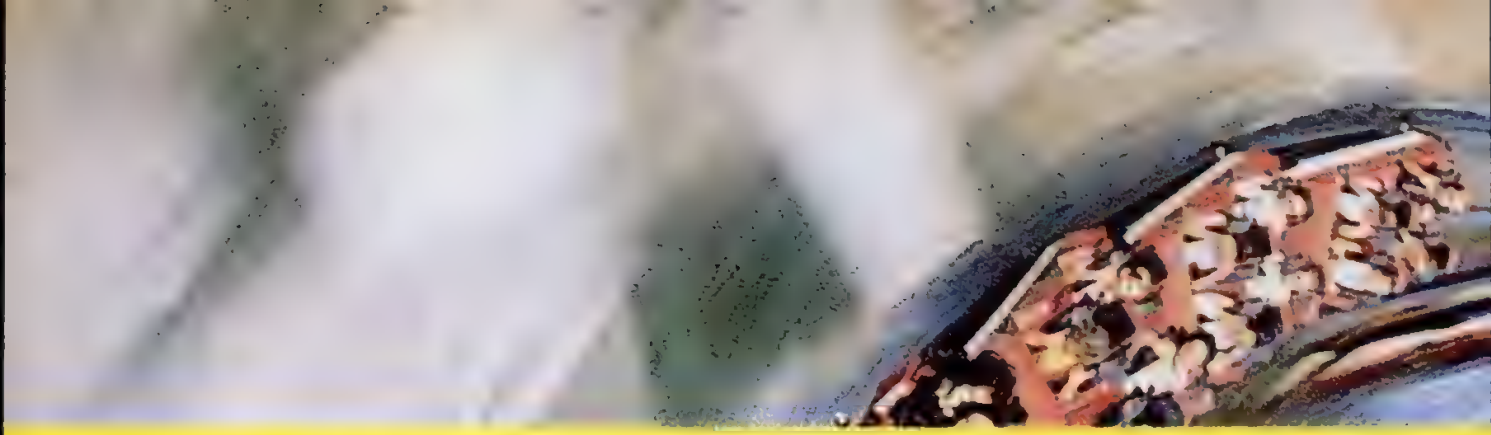

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by
Joe Salemi

Advisor

- 9,600 BPS ON AN XT: Can an XT support high-speed communications?
- COMMUNICATIONS REFERENCES: Where to find information on developing a communications application.

9,600 BPS ON AN XT

I was wondering how a 9,600-bit-per-second modem would work with my XT clone. I've read in *PC Magazine* that a weak link in the communications chain is the 8250 UART (Universal Asynchronous Receiver/Transmitter) chip usually found in XT machines.

Would replacing the 8250 UART with a 16550 UART be enough, or is the XT just too slow to handle a 9,600-bps modem?

Wayne Leishman
Waterloo, Ontario, Canada

Even with the 8250 UART, an XT can handle 9,600 bps with few problems; however, you may not be able to reliably take advantage of the faster port-to-modem speeds (such as 19,200 or 38,400 bps) that increase the speed of transfers when using a compression protocol such as V.42bis or MNP 5. The 16550AFN, the latest version of the 16550 chip, has an on-board 16-byte buffer that buffers the data between the port and the PC's data bus, helping to prevent data loss if data comes in faster than the PC can handle it.

Most communications programs support the 16550AFN. Some bugs were found in the earlier versions of the chip, but by specifying the AFN you can be sure of getting the correct one. The chip usually sells for around $20; one source is Jameco Electronics (1355 Shoreway Rd., Belmont, CA 94002; 415-592-8097).

Replacing the 8250 is relatively easy as long as it's mounted in a socket and not soldered onto the serial board directly. If the 8250 is soldered, consider bringing the board to a technician to install a socket for the UART, or replacing the board with one that already has a socket on it.

Most mail-order vendors and dealers carry a number of serial I/O boards. However, two popular boards that come with the 16550AFN already installed (or as an option) are the Hayes ESP Enhanced Serial Port card and the COMM+232 ISA serial card. The Hayes card (Hayes Microcomputer Products Inc., Norcross, GA 30092; 404-441-1617; $299 for ISA, $349 for MCA) has two 9-pin serial ports, each with a 16550AFN already installed, which can be assigned to COM1 through COM4. It was reviewed in First Looks in our December 25, 1990, issue. The COMM+232 ISA serial card (Sealevel Systems Inc., Easley, SC 29641; 803-843-4343; $169) has two 9-pin ports with socketed UARTs, and the 16550AFN chip is a $25 option per port. A First Looks review of this board was in the April 16, 1991, issue.

Note that the slower speed of XT-class systems means that the system is slower in servicing interrupts. When running your modem at speeds of 9,600 bps and above make sure you're not running anything else on the system that will slow its interrupt response. For example, don't run a 9,600-bps session in a DOS window of *DESQview* or Windows 3.0 while running another program in a different window. Some disk caching programs, such as Multisoft Corp.'s *Super PC-Kwik*, also have interrupt options that should be turned off if there are any problems with high-speed communications.

COMMUNICATIONS REFERENCES

I'm researching the development of a communications application that must provide direct support for as many modems and terminals as possible. I would like to obtain extensive information on these subjects from as few sources as possible. Can you help?

Andrew W. Ackard
Pompano Beach, Florida

While there is no single source for all the information you need, the best one I know of for information on programming communications software in general is the *C Programmer's Guide to Serial Communications* by Joe Campbell (Howard Sams, 4300 W. 62nd St., Indianapolis, IN 46268; ISBN 0-672-22584-0; $29.95). Though its primary focus is on C, the principles can easily be applied to other languages.

The Programmer's Guide to PC and PS/2 Video Systems by Richard Wilton (Microsoft Press, One Microsoft Way, Redmond, WA 98052; ISBN 1-55615-103-9; $24.95) provides information on programming the screen-handling aspects of your application. It covers all video standards from MDA to VGA.

Most modem vendors design a distinctive command language for their modems. To support every possible modem, you'd have to contact every modem manufacturer to get the specifications of its command language. Fortunately, the Hayes AT command set has become a de facto standard. Most modems provide a minimum subset of those commands with their own extensions, so you should be able to include at least some basic setup strings in your application.

A good source for the basic AT command set and other modem information is *The Modem Reference* by Michael A. Banks (Brady Books Inc., 15 Columbus Circle, New York, NY 10023; ISBN 0-13-589862-5; $27.95).

ASK THE ADVISOR

Send your question to Advisor, One Park Avenue, New York, NY 10016, MCI mailbox PC MAGAZINE, or upload it to PC MagNet (see the instructions for joining on page 10 of this issue). ■

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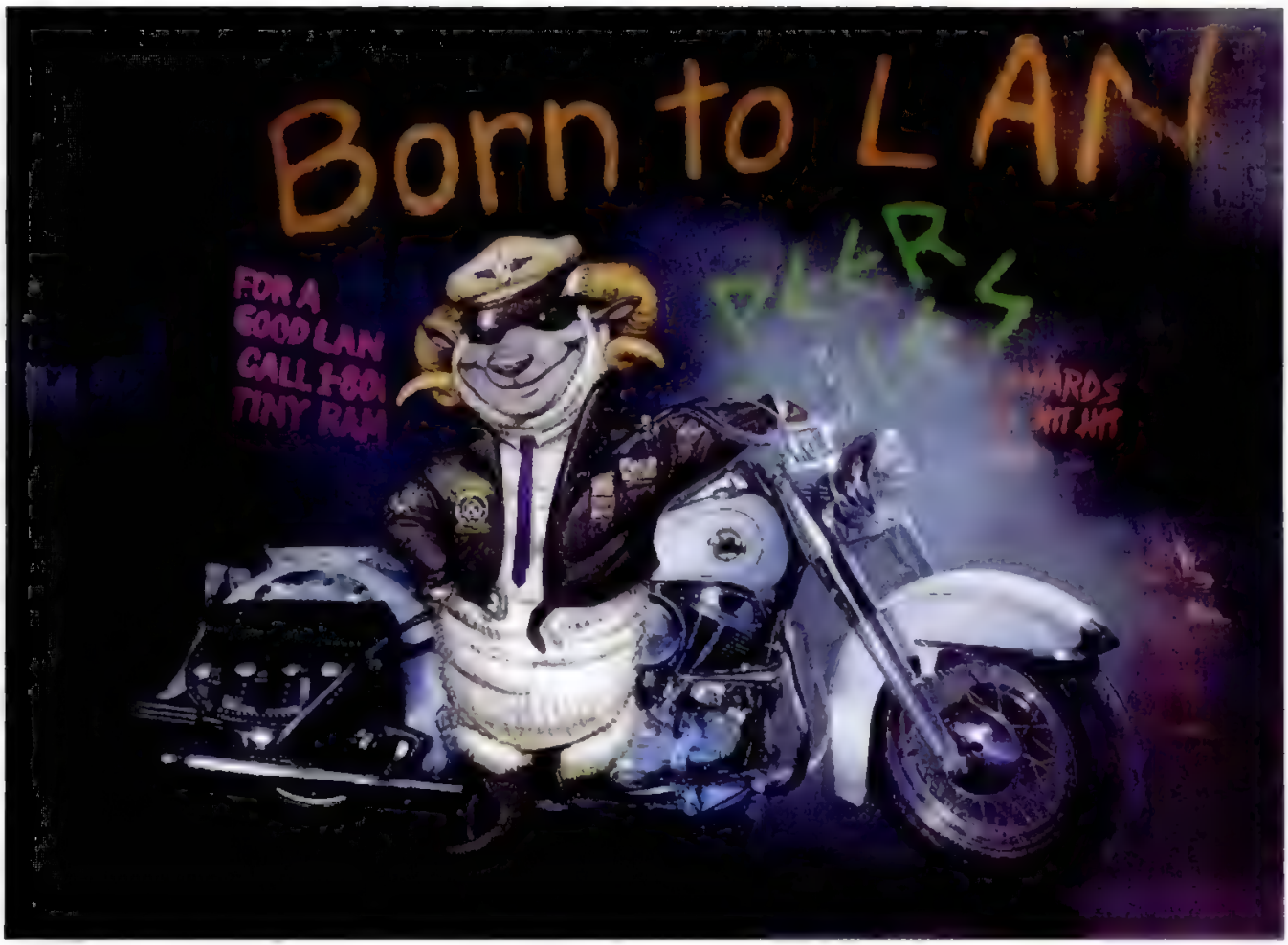

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by
Jeff Prosise

Tutor

TWO SIZE LIMITATIONS IN DOS

Can you explain what produces the 640K DOS barrier? Why can't Microsoft or other developers do anything about it? Also, what causes the eight-character filename limit and why can't that be increased?

Dale D. Murray
Mount Joy, Pennsylvania

■ TWO SIZE LIMITATIONS IN DOS: Why DOS can access only 640K, what limits filenames to eight characters, and what can be done about both.

We'll have to tackle this question in two parts because the reasons are disparate. First, some information about the 640K barrier and what makes it so difficult to overcome.

To understand the reason for the limit, you need to know something about the addressing capabilities of microprocessors. The amount of memory a microprocessor can read and write is determined by the number of address lines it contains. An *address* is a number representing a location in memory. An *address line* is a physical connection between the microprocessor chip and the PC's bus. One address line carries 1 bit of an address.

The number of bytes of memory that a microprocessor can address is equal to 2 raised to the power of the number of address lines. A microprocessor with 16 address lines, for example, can access 2^{16} or 65,536 (64K) different memory locations. A CPU with 20 lines can address 2^{20} locations or a full 1MB of memory.

Figure 1 lists the number of address lines and resultant addressing capabilities for prominent members of the Intel 80*x*86 microprocessor family. The 8088/8086 has 20 address lines, allowing it to use up to 1MB of memory. The 286 and 386SX have 24, providing them access to as much as 16MB of RAM. The 386DX, 486SX, and 486DX have 32 address lines, enabling them to access up to 4 gigabytes.

Unfortunately, the number of usable address lines at any moment depends on the microprocessor's mode. The 8086 runs only in real mode and all of its 20 address lines are active. When a 286, 386, or 486 runs in this mode, the processor emulates an 8086; thus only 20 of its address lines are active. To use all their address lines these chips must switch to protected mode in which DOS *can't* run—restricting even a 286, 386, or 486 to real mode under DOS. The operating system itself, as a result, is limited to 1MB of memory because that's all the microprocessor can address in real mode. (Some PCs can enable the 21st address line while in real mode, thus reaching into the first 64K of extended memory. On these machines DOS 5.0 takes advantage of this ability when you load it in the high memory area by adding a DOS=HIGH statement to CONFIG.SYS.)

On the surface, then, it appears that DOS is restricted to a maximum of 1MB of memory rather than 640K. So where does the 640K limit come from? When engineers at IBM mapped out the PC's memory (in late 1980 or early 1981), they arbitrarily reserved the upper 384K of its 1MB real-mode memory for hardware uses. (Hardware often takes up less than the entire section, however, leaving blocks of memory addresses free.) This area contains the video buffer (the region of memory that determines what displays on-screen), the ROM BIOS, and adapter ROMs and RAMs. Subtract 384K from 1MB and you get 640K—the amount left for DOS and DOS applications. That, in a nutshell, explains the 640K limit on DOS memory.

Despite these hardware restrictions, it is possible to get at more than 640K of memory from DOS, though doing so sometimes requires extraordinary measures. Here are some workarounds developers have come up with over the years:

■ *Extended memory*. Extended memory resides above 1MB and can exist on 286, 386, and 486 machines. Some DOS utilities such as SMARTDrive and RAMDrive store their data in extended memory by switching into and out of protected mode to transfer the information to and from conventional memory. Another trick involves exploiting hardware quirks that allow reaching into extended memory without leaving real mode (as with the 21st address line, discussed above).

In DOS 5.0 and Windows, extended memory placed under the control of HIMEM.SYS is also called XMS memory because the functionality for HIMEM.SYS is defined in Version 2.0 of the 1988 Extended Memory Specification. Note that because of the way memory is configured in a PC, a system with 1MB of usable RAM actually contains 384K of extended memory.

■ *Expanded memory*. Expanded memory conforms to the Lotus/Intel/Microsoft Expanded Memory Specification (LIM EMS). Introduced in 1985, EMS defines a means for accessing large amounts of RAM by swapping it—in 16K increments—into and out of a 64K window in the microprocessor's address

ADDRESSING CAPABILITIES OF THE INTEL 80*x*86 FAMILY

Microprocessor	Address lines	Addressable memory
8086 8088	20	1MB
286	24	16MB
386SX	24	16MB
386DX	32	4GB
486SX/DX	32	4GB

Figure 1: The chart shows the number of address lines for several members of the Intel 80*x*86 microprocessor family and the corresponding maximum addressable RAM.

space (usually in an unused region between 640K and 1MB). Version 3.2 of the spec provides for up to 8MB of extra RAM, while Version 4.0 supports as much as 32MB.

Expanded memory can be installed on any PC regardless of processor type, usually in the form of an add-in board. 386 memory managers such as *386MAX*, *QEMM-386*, or DOS 5.0's EMM386 .EXE, however, can convert extended to expanded memory on 386 and 486 systems. Using utilities such as *PC Magazine*'s own EMS40.SYS, it's even possible to convert extended memory on 286 PCs to expanded.

■ *UMBs and 386 memory managers.* UMB stands for upper memory block: the term for pockets of usable RAM that 386 memory managers can create (between 640K and 1MB) by running DOS in the Virtual 86 mode of the 386 and manipulating the processor's page tables. (The 386 uses values in the page table to convert linear addresses to physical addresses. Memory accesses can be rerouted transparently from one RAM location to another, as a result.) Special tools such as DOS 5.0's LOADHIGH and DEVICEHIGH let you load TSRs and device drivers into the UMBs, freeing RAM in the lower 640K for running normal programs. UMB-aware DOS programs can also allocate these blocks of memory for themselves.

■ *DOS extenders.* Phar Lap Software and others have created special packages called *DOS extenders*, which allow DOS applications to run in protected mode (on a 286, 386, or 486) where they enjoy access to the processor's full 16MB or 4GB address space. The products accomplish this magic by wrapping a protected-mode shell around DOS and intercepting calls to operating system services. The extender handles some calls while others are passed through to DOS after switching back to real mode. Programs generally require modification before they're capable of running in such an environment so extenders—while useful for developing high-end software such as *AutoCAD*—offer no panacea for the memory woes of everyday users.

Notably, DOS must go out of its way to employ any of these methods. Applications must be specially written to take advantage of extended or expanded memory, for example; they can use neither by default. The one exception is with 386 memory managers that add RAM to the lower 640K contiguously. *QEMM-386*'s VIDRAM utility, for instance, tacks as much as 96K of usable memory onto the lower 640K. It reclaims video RAM installed on an EGA or VGA, or maps expanded memory into the areas normally reserved for the video buffer if there's no RAM present at those addresses.

It works when the majority of your programs run in text mode and the text-mode video adapter doesn't use any memory in the A000h segment. Color adapters leave the first half of the B000h segment free, also. Since this RAM is contiguous with the lower 640K, DOS can use it as if it were conventional memory.

You can see the effect of this firsthand if you own DOS 5.0 and a 386 or 486. Install EMM386.EXE with an `I=A000-AFFF` switch, which converts the A000h segment of memory to usable RAM. DOS will automatically append this memory to the lower 640K. Type MEM and you're liable to see a large executable program size approaching 700,000 bytes. This works fine as long as you remain in 25-line text mode (it has strange side effects if you switch to 43- or 50-line text modes). If, however, you run a program that switches to one of the EGA/VGA graphics modes that uses the A000h segment of memory (modes 13 and higher), your PC may crash. Why? Because when a program writes an image to the video buffer, it will overwrite any data already stored there. This "data" could include memory control blocks placed there by DOS.

Nonetheless, this is one of the few ways you can add memory to a 640K PC so it's usable by all application programs. By the way, you do *not* need to have a DOS=UMB statement in your CONFIG .SYS file for this to work. Technically, the extra memory isn't "upper" memory because it's tacked onto the end of conventional memory. Therefore, the UMB qualifier is not required.

Now for the second part of your question: the business about 8-character filenames. Technologically, there's nothing difficult about implementing longer ones. It's just that the 8.3-character filename format (8 characters in the primary name, plus 3 in the extension) is used in several important data structures that are internal to DOS. Changing the filename format would mean changing the size and layout of these structures. This would, in turn, render new versions of DOS incompatible with applications that work at the heart of the DOS file system. That's a gamble even Microsoft has been unwilling to take so far.

One of the structures that would be affected if the filename format was changed, for example, is the 32-byte directory entry (diagrammed in Figure 2). For every file it establishes on a disk, DOS creates a directory entry containing the filename and extension, the file attributes, the date and time the file was created or last modified, the starting cluster number (the location on the disk where the first cluster of the file is stored) and the file size.

THE FORMAT OF THE 32-BYTE DOS DIRECTORY ENTRY

Offset	Size	Description
00h	8 bytes	Filename
08h	3 bytes	Filename extension
0Bh	Byte	File attributes: Bit 0 = Read only Bit 1 = Hidden Bit 2 = System Bit 3 = Volume label Bit 4 = Subdirectory Bit 5 = Archive
0Ch	10 bytes	Reserved (unused)
16h	Word	Time the file was created or last modified
18h	Word	Date the file was created or last modified
1Ah	Word	Starting cluster number for the file
1Ch	DWord	File size in bytes

Figure 2: This chart illustrates the layout for DOS directory entries and defines each field.

Filename limitations will probably be overcome in future releases of DOS. One enhancement we're likely to see in future versions is support for installable file systems, something like OS/2's High Performance File System (HPFS), which supports long filenames. In fact, if you read Andrew Schulman's excellent book, *Undocumented DOS*, you'll learn that Version 4.0 contains undocumented hooks for installable file systems that were never fully realized. Look for this subject to resurface in the future, perhaps when and if DOS 6.0 becomes a reality.

> **One enhancement we're likely to see in future versions of DOS is support for installable file systems that allow long filenames.**

The issue of memory management is more formidable. It's very difficult, if not impossible, to make extra RAM available to DOS seamlessly, given its current structure and the makeup of today's application programs—both inextricably tied to real mode of the Intel 80x86 microprocessor family. Unless we end users are willing to give up old habits and move on to a protected-mode operating system such as Unix or OS/2, we may be bound by the limitations of DOS for a long time to come.

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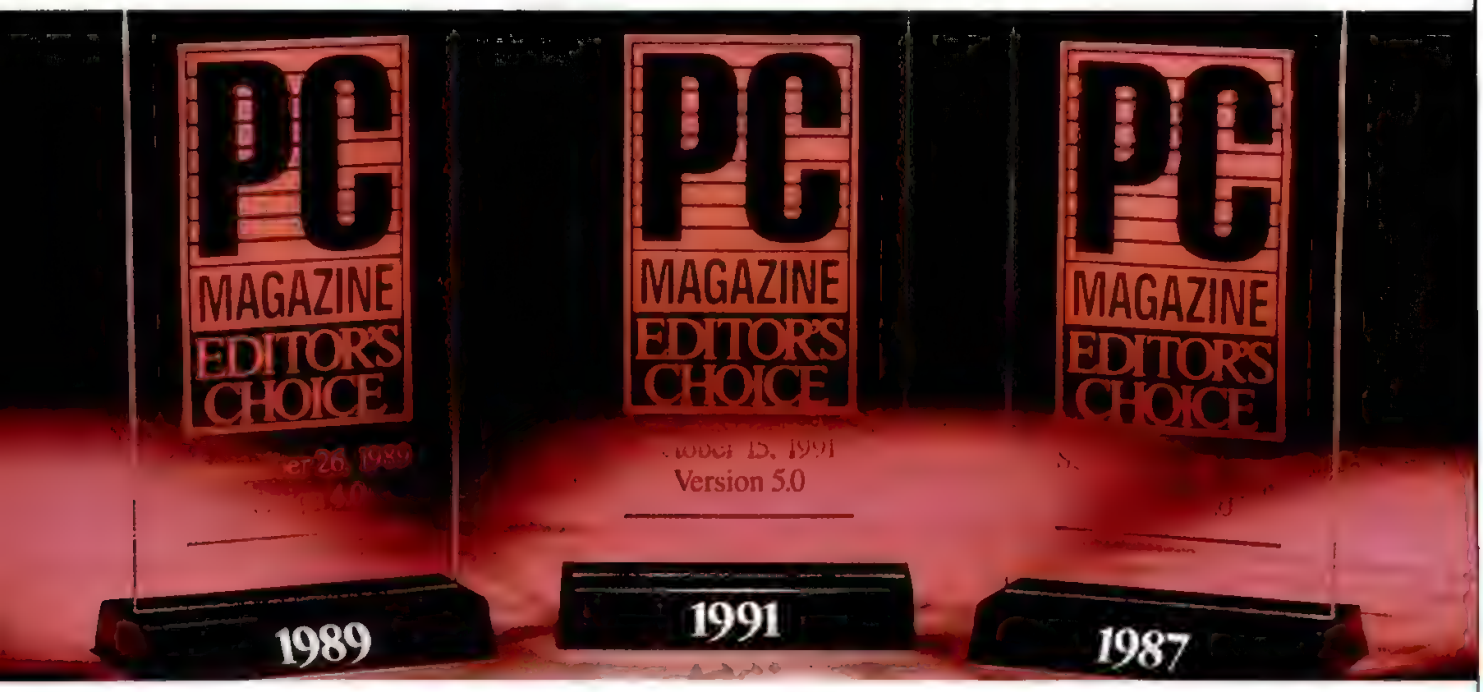

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by
Neil J. Rubenking

User-to-User

DOS DELIMITERS

I've discovered an interesting oddity in the way replaceable parameters (%1, %2, and so forth) are handled in batch files. It seems that in addition to space and tab characters, DOS also uses the comma, the semicolon, and the equal sign as separators for command line parameters during batch file processing. This is easy to test. Create a file, TEST.BAT, containing only the line `REM %1 %2`. Then, if you type TEST A=B at the DOS prompt, you'll get `C>REM A B`. A has been assigned to %1, B to %2, and the equal sign has been replaced with a space. The same thing happens if either the comma or the semicolon is used.

I discovered this quirk the hard way. I have a Turbo Pascal program, CALK.COM, to which I pass a command line parameter of the form C=*nn*, where *nn* is a number. When I used the program from the DOS prompt (say, CALK C=45) it worked fine. But when I created a batch file, CALKALL.BAT, containing the line `CALK %1 %2`, my program didn't work. I expected that if I typed `CALKALL C=45`, C=45 would be assigned to %1. However, DOS replaced the equal sign with a space before assigning values to any parameters. So C was assigned to %1, and 45 to %2; the equal sign simply vanished.

From now on, I'll avoid using these characters in command line parameters that I might like to run from batch files.

Kim Agrawal
Pondicherry, India

PC MAGAZINE DOS also accepts any of the space, tab, semicolon, comma, or equal sign characters as the delimiter between elements in a FOR list. You can use that fact to write a batch file that executes a certain command in every directory of the PATH. Within the batch file, put the command

```
FOR %%f IN (%PATH%) DO MYPROG %%f
```

MYPROG can be a program or (more likely) another batch file. DOS expands %PATH% into the current contents of the PATH, and the FOR command passes each directory in turn to MYPROG. The only potential problem here occurs if the PATH is too long; the batch line above must not be more than 127 characters *after* %PATH% is expanded.

DOSKEY macros in DOS 5.0 also use replaceable parameters, signified by $1, $2, $3, and so on. However, when parsing the parameters for a DOSKEY macro, DOS does *not* consider the comma, semicolon, or equal sign to be a delimiter. Try it. Create a macro TEST with the line

```
DOSKEY TEST=REM (1)"$1", (2)"$2"
```

Now type TEST A=B, and you'll see that parameter 1 is "A=B" and parameter 2 is empty!

- DOS DELIMITERS: For better or worse, DOS uses more than just spaces to separate batch file parameters.
- USING THE /F SWITCH: The undocumented /F switch makes it easier for DOS 5.0 users to deal with empty disk drives.

USING THE /F SWITCH

I want to pass along an undocumented DOS tip that I learned at the Novice SIG of the South Jersey IBM PC Users Group.

If you've ever typed A: or B: with no disk in the drive, you've seen the message

```
Not ready reading Drive A
Abort, Retry, Fail?
```

You get this error message until you relent and place a disk in that drive.

The F (for Fail) switch to the rescue! Add /F at the end of the SHELL= statement in your CONFIG.SYS file, so that the command looks something like this:

```
SHELL=C:\DOS\COMMAND.COM C:\DOS /P
 /E:256 /F
```

Now if you try to change to a drive that's empty, the error message will read:

```
Not ready reading Drive A
Abort, Retry, Fail?Current drive
 is no longer valid>
```

You can then type C: and resume your work.

George W. Rea
West Cape May, New Jersey

PC MAGAZINE The South Jersey IBM PC Users Group must have quite a Novice SIG to come up with an undocumented switch for DOS 5.0! I hadn't learned about the /F switch myself until a few weeks before receiving this letter. It's strictly a DOS 5.0 specialty. In any recent version of DOS, you'll get the Abort, Retry, Fail? message if you try to switch to a drive that's empty or otherwise not available. Press F for Fail and the "Current drive is no longer valid>" prompt appears. The thing is, you *always* have to either press F or insert a disk in the drive. Adding the F switch effectively makes DOS press F for you. If this happens on an empty floppy disk drive, you have the option of inserting a disk in the drive and accessing that drive again. I've added the /F switch to the SHELL= line in all of my various versions of CONFIG.SYS.

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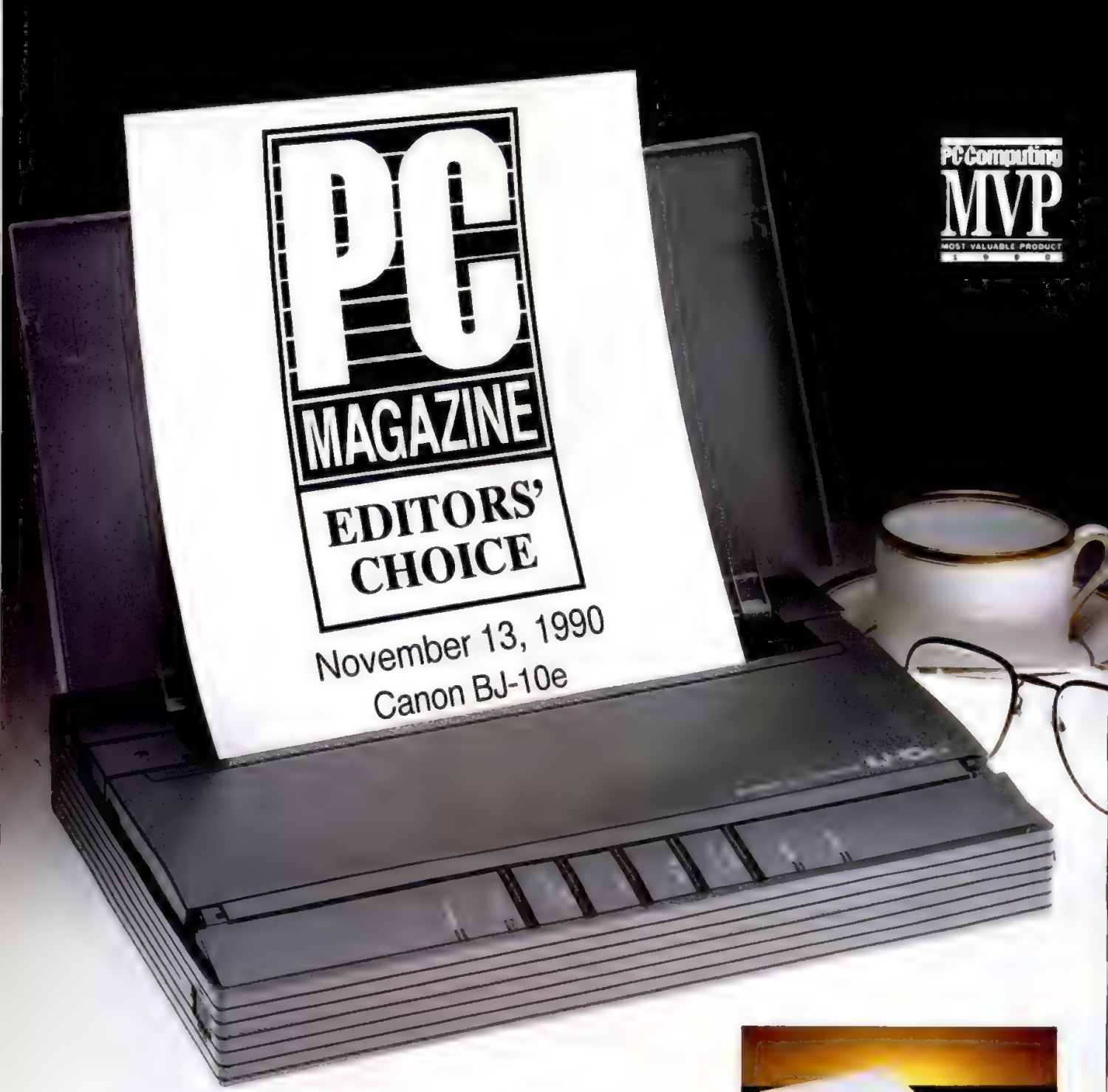

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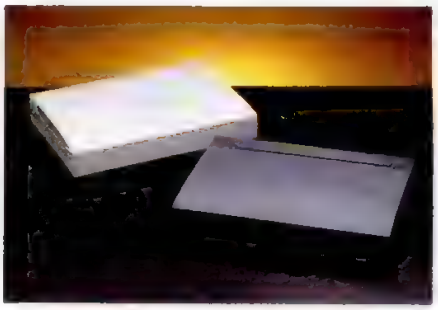

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CIRCLE 187 ON READER SERVICE CARD

by
Fran Finnegan

Windows

A SINGLE-PROGRAM ENVIRONMENT

It's possible to set up Windows as the environment for just a single application. I recently came across a situation where I needed to run a Windows application from a DOS-based menuing program and then return to the DOS menu upon completion of that program. The first thing I tried was to execute "WIN *PROGRAM*.EXE", where *PROGRAM* is the name of the Windows application. However, on exiting the Windows program, you are left in Windows with the Program Manager or File Manager minimized. This can be very confusing to the user, who instead expects to see the DOS menu.

A simple solution was to name the Windows application as the shell in SYSTEM.INI. After you've done this, exiting the Windows application returns you to the menu or DOS, depending on where you started.

Dinesh Mahbubani
Silver Springs, Maryland

PC MAGAZINE There's a line in the [boot] section of SYSTEM.INI that begins with `shell=`. It specifies the Windows shell of your choice (PROGMAN.EXE by default). This is the program that Windows starts after it has initialized itself, and the last program that Windows expects to be around when you exit Windows. This shell will be started before any programs on your Windows command line. As Mr. Mahbubani rightfully indicates, you can name any program as your shell, and it will have control over the whole Windows environment at start-up. If it's the last (or in the case of this particular tip, the only) program that you exit, then you will be exiting to DOS.

In the days of Windows 1.*x* and 2.*x*, there were Windows applications that shipped with runtime-only versions of the Windows environment, so that the user did not have to have Windows in order to use the program. In those days, the misnamed MS-DOS Executive served as the shell. It was not included in the runtime-only version, so you returned to the DOS prompt when you exited the application. Microsoft eventually abandoned the notion of offering developers a runtime-only version of Windows to ship with their packages. But as you've seen by now, there is a way to re-create that type of system.

- A SINGLE-PROGRAM ENVIRONMENT: Microsoft no longer offers a runtime-only version of Windows, but here's a way to re-create that type of environment.
- THE WINDOWS 64K BARRIER: Removing Real mode support from Windows 3.1 won't eliminate the 64K Free System Resources constraint.

THE WINDOWS 64K BARRIER

Rumor has it that Windows 3.1 will no longer be compatible with the Intel 8086 and 8088 microprocessors, because it will not contain Real mode. Since support for these chips was the reason for the ridiculous "Free System Resources" limitation, does dropping this support mean that Windows 3.1 will break what you called "the Windows 64K barrier" imposed by Free System Resources (in your November 12, 1991, column)?

Mark Avery
Honolulu, Hawaii

PC MAGAZINE While it is true that Windows 3.1 will not support Real mode or run on an 8088/8086, it's actually *not* true that the 64K limitation on Free System Resources is caused by compatibility with the 8086/8088. Instead, the 64K FSR barrier results from the memory segmentation model implicit in the various operating modes of the entire 80*x*86 product line. While it is true that Windows 3.1 will not have a Real mode, and therefore will not run any 80*x*86 in real mode, the 64K FSR constraint will still exist. This is because Standard and 386 Enhanced modes will still run the 80*x*86 in 16-bit protected mode, in contrast to Windows NT running the 80386 or better in 32-bit protected mode. Windows NT (New Technology) is Microsoft's planned high-end version of Windows, which will run in what will be called Windows *NT mode;* it won't be ready until late 1992 or 1993.

The FSR problem will be alleviated in Windows 3.1 because of better management of the 64K-maximum data segments of Windows (USER.EXE's and GDI .EXE's local data segments), but the absolute constraint and limitation will still be with us for a long time. We can only hope that Microsoft keeps as much as possible out of USER's and GDI's local heaps in future versions of Windows; this is already beginning to happen in Windows 3.1. Until that time, you can use my WINFSR program to monitor your Free System Resources to make sure that you don't hit this 64K barrier and crash Windows 3.*x*. (See the November 12, 1991, Windows column for a complete discussion of WINFSR.)

To understand this limitation, study the various modes that the 80*x*86 can be operated in, as shown in Figure 1. The 80*x*86 operates in either real or protected mode, as determined by bit 0 of the 80286-or-better's Control Register 0 (CR0). In real mode, an applications' addressing and instruction-set word size and its application program interface (API) to Windows are both 16 bit.

In protected mode, the addressing and instruction-set word size and the API may be *either* 16 bit or 32 bit, as determined by bit 54 (which is actually the D bit) of a protected-mode memory descriptor. Vir-

WINDOWS' MODES

Intel Microprocessor Chip	Windows' Mode	Chip's Operating Mode	Applications' Addressing and Instruction-Set Word Size and API	Virtual 86 Mode and Paging Mode (Swapping)
8086/8088	3.0 Real	Real	16 bit	No
80286	3.0 Real	Real	16 bit	No
	3.0/3.1 Standard	Protected	16 bit	No
80386/80486	3.0 Real	Real	16 bit	No
	3.0/3.1 Standard	Protected	16 bit	No
	3.0/3.1 386 Enhanced	Protected	16 bit	Yes
	NT (New Technology)	Protected	32 bit	Yes

Figure 1: How Windows' modes correspond to various modes of the Intel 80x86 microprocessors.

tual 86 mode, which is used for DOS shells under 386 Enhanced mode, is yet another 80386-or-better mode; it and the virtual-memory paging mode (a.k.a. swapping) are also available in protected mode by setting up various data structures and registers.

Since Windows will not have a 32-bit API until Windows NT is released, it essentially remains a 16-bit operating system, from the point of view of an application. (Device drivers, however, are currently permitted to operate in 32-bit protected mode under 386 Enhanced mode.)

It's the "16-bit" part of the mode—which affects the addressing and instruction-set word size and an integer's natural size—that causes the 64K FSR limit. That's because a 16-bit protected-mode *selector:offset* address is the same physical size (16:16 bits) as a 16-bit real-mode *segment:offset* address, which means that the largest memory segment addressable via the 16-bit offset is still 64K (2^{16} is 64K). That and the Windows 3.*x* 16-bit API, in which "handles" are really 16-bit offsets, are what cause the FSR limitation. In the 32-bit protected mode of Windows NT, the offset portion of the selector:offset address becomes 32 bits wide (16:32 bits), and the 64K segment limit disappears, because a 32-bit offset can address a 4-gigabyte memory segment (2^{32} is 4G).

OPENING WINDOWS

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CIRCLE 013 ON READER SERVICE CARD

by
M. David Stone

The Working Word

PORTRAIT WITH LANDSCAPE

If your printer has the ability to rotate fonts, *WordPerfect* will let you print both portrait- and landscape-oriented text on the same page when you place the landscape text in a graphics box.

Although *WordPerfect* offers more than one box selection, it doesn't actually matter which type you select; they are all functionally equivalent. But each type of box has a different set of defaults. By default, a User Box has no borders, no inside border space, and a 0.167-inch outside border space. You can change any of these settings (for any type of box), by choosing Options instead of Create at the second-level menu.

To create the box, press Alt-F9 for Graphics, select User Box, then Create. Then choose Anchor Type, set the choice to Page, and accept 0 for Number of pages to skip. Next, you set the size; you can usually accept Auto Both, to let *WordPerfect* adjust the size. Make sure Wrap Text Around Box is set to Yes (the default). You may also want to set Vertical Position and Horizontal Position.

Finally, select Edit, which will take you to the Box Edit screen. You can now enter the text you want rotated, using *WordPerfect*'s usual text-editing functions. While still in the Box Edit screen, press Alt-F9 for the rotation choices (0, 90, 180, and 270 degrees). The rotation is counterclockwise, so 90 degrees will put the left edge closest to the bottom of the page. Use F7 to exit the Box Edit screen, and then hit Enter to exit the Graphics menu. To check your results, print the page (Shift-F7, P) or use the Print, View Document command (Shift-F7, V).

Rebecca Anderson
Redmond, Washington

PC MAGAZINE The technique described here applies to both *WordPerfect* 5.1 and 5.0, though 5.0 users will find some differences in the menus. Version 5.1's User Box is a User-defined box in 5.0, Full choice for margin under Horizontal Position is labeled Both Left & Right, the choice of Anchor Type is simply Type, and you don't get the additional prompt for pages to skip. (Version 5.0 assumes you want the box on the current page, unless you force it to a later page by inserting hard carriage returns before the code that defines the box.) Version 5.0 also lacks an Auto Both choice for size, but with the exception of this and the Number of pages to skip prompt, these differences are all limited to the changes in labels, not the functions of the commands.

■ PORTRAIT WITH LANDSCAPE: Get portrait and landscape text on the same page in *WordPerfect* 5.0 and 5.1.

Although every step here is spelled out in the *WordPerfect* reference manual, the implications for using these features to rotate text (or graphics for that matter) are not. As a result, we've received tips from users who have managed to get the same effect by embedding arcane printer control commands in their document, rather than using the straightforward, menu-driven procedure that's built into *WordPerfect*.

As Ms. Anderson suggests, *WordPerfect* will let you rotate the text or graphics in a box of any size, and will let you rotate it independently of anything else on the page. However, the most likely reason you'd want to use this feature is for landscape printing an entire page in a document that is otherwise printed in portrait orientation—a common need when including a text or graphics chart that's too wide to be printed in portrait. By rotating the contents of the box without rotating the entire page, you can still print the header in portrait orientation.

Alas, there is one unavoidable limitation to *WordPerfect*'s ability to rotate text: Your printer has to be capable of it. The technique works with PostScript printers; for example, the LaserJet III or the Canon LBP-8III. But your printer may not be able to do this.

In particular, the LaserJet Series II, earlier LaserJet models, and most compatibles can't handle different text orientations on the same page. If you're using one of these printers and you set up *WordPerfect* to print text in two orientations on one page, the command for switching orientations will automatically force a new page.

There is a way around this limitation. The LaserJet II may balk at two different text orientations on one page, but it doesn't even notice a rotated graphic. That means you can get almost the same effect by creating text as a graphic, inserting the graphic in a box and then rotating the graphic. The quality of the text will be limited by the quality of the graphic. But if you start with a high-quality graphic, and set the Graphics Quality choice on the Print menu to High, you can still get reasonably attractive results.

Note that you can create the text with any graphics program that saves its files in any of the formats *WordPerfect* reads directly or can convert with its conversion utility, GRAPHCNV.EXE. (This covers most common formats, including, for example, .PCX and TIFF files.)

If you don't have a graphics program, you can also use *WordPerfect* itself to create the text, as long as you have a graphics card and monitor. Start by loading GRAB.COM before loading *WordPerfect*. GRAB.COM is the screen grabber utility that comes with *WordPerfect*. You can use it to capture screen images—when the screen is in a graphics mode, like the one *WordPerfect* uses for print preview—and save them in *WordPerfect*'s .WPG format. The first screen capture will automatically be named GRAB.WPG, the second GRAB1.WPG, and so on.

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CIRCLE 158 ON READER SERVICE CARD

With GRAB.COM loaded, load *WordPerfect* and enter the text you need as a standard *WordPerfect* document. Then go to the Setup screen with Shift-F1, and choose Display, View Document Options, and make sure the Text in Black & White option is set to Yes. (In 5.0, there is no View Document Options choice. But there is a choice to View Document in Black & White on the Display menu. Note that if you don't set the option for viewing black and white text to Yes, you'll wind up with a shading effect behind the text. In some situations, you may consider the shading desirable.)

Next, exit to the editing screen with F7 or Enter. Then go to print preview mode (Shift-F7, View Document), and adjust the screen so that you can read the text. (In most cases you'll want to view the screen at 100 percent.)

To capture the text with GRAB, press Alt-Shift-F9. You should then hear a two-note beep and see an animated dotted-line box on-screen. The box indicates the capture area. You can adjust its size by holding Shift down as you use the arrow keys, or adjust its position with the arrow keys alone. When the box is properly adjusted, hit Enter to save the image. When GRAB is finished, it will beep again.

At this point, you have a file on-disk with a graphics image of the text you want to use. (Note that GRAB saves the file in the currently active directory. So if you were logged in to your data directory before capturing the image, that's where you'll find the file.) But be sure to save the text file as well, in case you want to make changes to it later.

Now open the file that you want to place the graphics image in. Go to the place where you want the graphics text in landscape mode, enter a page break with Ctrl-Enter, and now you're ready to create the graphics text box.

Choose Alt-F9 for the Graphics menu, then any of the graphics box types. Next, choose Create, Filename, enter the name of the file (presumably GRAB.WPG, though you can also use F5 to see a list of files and pick from the list). Set the Anchor Type (Type in 5.0) to Page, Number of pages to skip at 0 (again, you won't see this choice in 5.0), Vertical Position to Full Page, and Horizontal Position, Full (Both Left & Right in 5.0).

Finally, choose Edit to see the Graphics editor, choose Rotate, then enter 90 degrees and answer No when *WordPerfect* asks whether to use a Mirror image. You can now use the usual Graphics editor commands to move the text within the box, scale the text, and so on. When you're done, exit with F7 or by entering 0, and return to the editing screen. When you print the file, you'll find you can print a portrait header on the same page with the rotated text.

One last note on this procedure: The quality of the graphic-text image will not be on a par with standard printer fonts, because you are limited by the resolution of the screen. However, note that you can use any font you like—even those that you don't have in your LaserJet II. You can, for example, create the text with *WordPerfect* installed for a PostScript printer, format it as, say, 15-point New Century Schoolbook, and capture a screen using that font. If you're willing to explore the different fonts and the effects of using different font sizes and enhancements, you'll find you can get quite reasonable results.

If your printer is incapable of handling portrait and landscape on the same page, you can still get quite reasonable results by rotating a graphics box.

TIPS FROM WORKING WORDSMITHS

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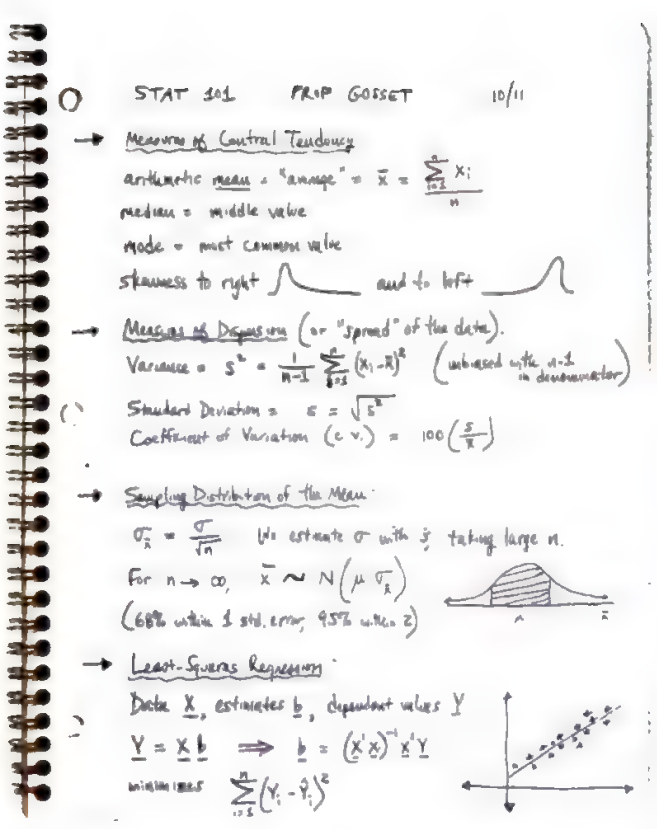

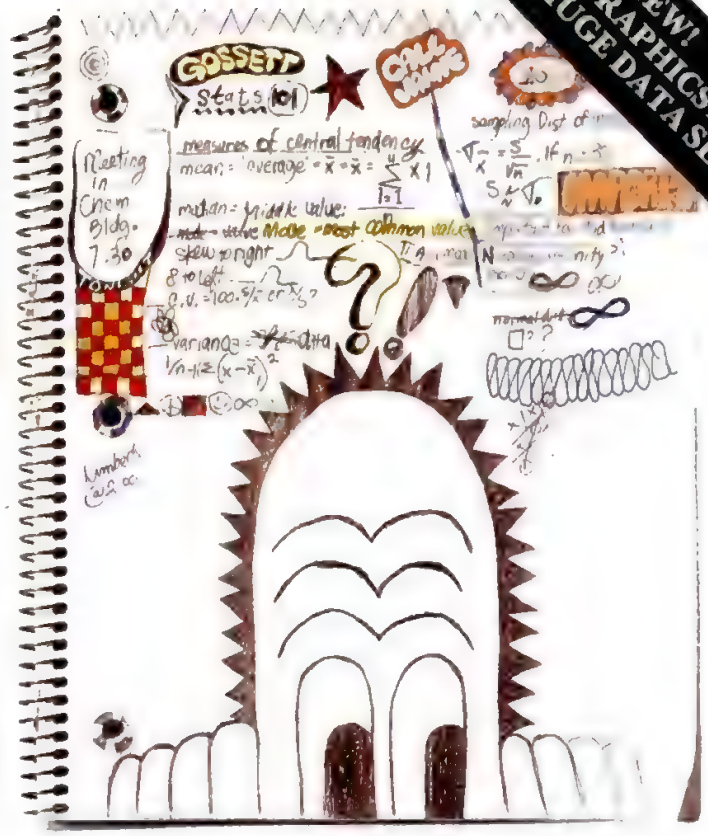

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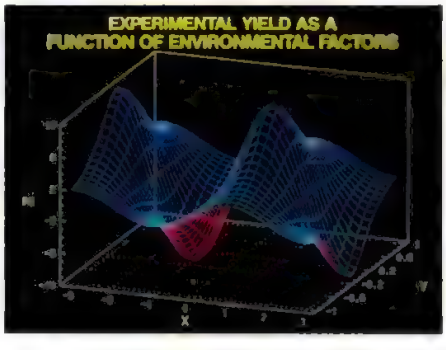

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PC MAGAZINE EDITORS' CHOICE March 14, 1989 STATGRAPHICS

CIRCLE 365 ON READER SERVICE CARD

by
Craig Stinson

Spreadsheets

CHANGING EXCEL'S FILE OPEN FILESPEC

I import a lot of ASCII text files into *Microsoft Excel*. The File Open command in *Excel* normally displays only your *Excel* files (*.XL*); this makes it awkward to load files with other extensions. I discovered that if I give my text files the extension .XLT, *Excel* will list them in the File Open dialog, right along with the .XLS, .XLC, and .XLM files. This naming convention saves me a few keystrokes every time I load a text file.

I have also put the line

```
XLT=D:\EXCEL\EXCEL.EXE ^.XLT
```

in my WIN.INI file. This allows me to double-click on an .XLT file in Program Manager or File Manager and start *Excel* automatically with one of my text files.

Doug Mitchell
Huntsville, Alabama

PC MAGAZINE *Excel* itself uses the extension .XLT for its template files. If you never use this feature of *Excel*, giving the .XLT extension to your ASCII files makes good sense. And even if you do use templates, assigning the same extension to both templates and text files won't trip the program up. *Excel* determines the nature of a file by its contents, not by its extension. So if this procedure works for you, by all means use it.

You can extend the idea to other kinds of files as well. For example, if you're converting from *Lotus 1-2-3* to *Excel* and find yourself importing a lot of .WK1 files, try renaming them all with the DOS command

```
RENAME *.WK1 *.XL1
```

That way, they'll all appear automatically in *Excel*'s File Open dialog box; you won't have to go through the annoying process of changing the dialog's wildcard spec (or typing the full filename) each time you import a *1-2-3* worksheet. If you

■ CHANGING EXCEL'S FILE OPEN FILESPEC: Easier ways to open files with extensions other than .XL*.

rename your .WK1 files with another extension, such as .XL1, you'll still be able to read them into *1-2-3*. Like *Excel*, *1-2-3* doesn't care what extensions your files have. The program's /File Retrieve command displays filenames with the extension .WK1, but you can use any extension you please.

If you import a lot of non-*Excel* files into *Excel*, you might want to consider adding a more versatile File Open command to *Excel*'s menu bars. The macro listed in Figures 1 through 4 shows one way this can be done. The macro puts a command called Open Special on the File menu of five of *Excel*'s menu bars—the full and short variants of the worksheet and chart menu bars and the "nil" menu (the menu that appears when there are no visible files open in your workspace).

If you choose this command on any of these five menu bars, *Excel* displays the dialog box shown in Figure 5. This dialog gives you five radio buttons—for .WK1 files, .WK3 files, .TXT files, .XL? files, and None of the Above (*.*). Choose an option and click OK, and *Excel* displays its File Open dialog box with the selected filespec in place. For example, if you choose the first option and click OK, *Excel* gives you its customary File Open dialog box, but modifies the file list to display .WK1 files instead of *Excel* files.

By naming this macro AUTO_OPEN, saving the macro sheet as an add-in, and storing the resulting .XLA file in the XLSTART subdirectory of your EXCEL directory, you can have the Open Special command appear on your menus automatically each time you run *Excel*. To save the file as an add-in, just use the Save As command and click on the Options button. In the File Format list box, choose Add-In; *Excel* will automatically give your file the extension .XLA. When you open the file subsequently, *Excel* will automatically hide it so that it doesn't get in your way. If you want to modify it later, just bring it back to the desktop with the File Open command but hold down the Shift key when you click OK. *Excel* will then load it and keep it visible.

Here's a quick tour of the macro. If you work through this discussion, you should find it relatively straightforward to modify the macro for the types of files

OPENSPEC.XLA A1:A7

	A
1	Auto_open
2	=ADD.COMMAND(1,"File",open_spec,"Close")
3	=ADD.COMMAND(2,"File",open_spec,"Close")
4	=ADD.COMMAND(3,"File",open_spec,"Delete...
5	=ADD.COMMAND(5,"File",open_spec,"Close")
6	=ADD.COMMAND(6,"File",open_spec,"Close")
7	=RETURN()

Figure 1: The ADD.COMMAND functions in this part of the OPENSPEC macro each put a new command on the File menus of *Excel*'s various menu bars.

OPENSPEC.XLA N1:R2

	N	O	P	Q	R
1	Command name	Macro name		Status message	Help topic
2	Op&en Special	Openspec.xla!Openspecial		Open a non-Excel file	

Figure 2: This section of OPENSPEC.XLA specifies the name of the command to be added to the File menu, tells where the macro to be executed is located, and presents a status message. No help text was added for this self-explanatory command.

OPENSPEC.XLA C1:C18

	C
1	OpenSpecial
2	=DIALOG.BOX(mydialog)
3	=IF(C2=FALSE,HALT())
4	=IF(result=1)
5	= OPEN?("*.WK1")
6	= HALT()
7	=ELSE.IF(result=2)
8	= OPEN?("*.WK3")
9	= HALT()
10	=ELSE.IF(result=3)
11	= OPEN?("*.TXT")
12	= HALT()
13	=ELSE.IF(result=4)
14	= OPEN?()
15	= HALT()
16	=END.IF()
17	=OPEN?("*.*")
18	=RETURN()

Figure 3: This part of OPENSPEC.XLA determines which filespec you chose and acts accordingly.

that you need to import.

The main business of the macro takes place in cells A1 through A7 (see Figure 1). The first cell in this range is named Auto_open, which makes the macro execute automatically whenever the macro sheet is loaded. Cells A2 through A6 each use the ADD.COMMAND function to put a new command on the File menu of one of *Excel*'s standard menu bars. The ADD.COMMAND function takes four arguments: a menu-bar number, a menu name, a reference to a location on a macro sheet where the details about the new command are specified, and an argument that tells *Excel* where on the specified menu to insert the new command. This last argument is optional; if you omit it, *Excel* puts the new command at the bottom of the specified menu.

The ADD.COMMAND function in cell A2 tells *Excel* to put a new command on menu-bar number 1 (the full-menu version of the Worksheet menu bar), to add this command to the File menu, to get the details about the command from the range named open_spec (on the current macro sheet), and to insert the new command directly above the File menu's Close command. The other ADD.COMMAND functions work the same way for different menu bars, and each one references the same macro-sheet range—the range named open_spec.

Figure 2 illustrates the contents of open_spec. The name open_spec is actually assigned only to the cells N2:R2. The labels in N1:R1 are there only to help us; *Excel* doesn't need them, and the range name included in the ADD.COMMAND functions must not include that label row.

The first cell in open_spec, N2, tells *Excel* what to name the new command. Note the ampersand; the character that follows the ampersand will be underlined on the menu. The second cell, O2, tells *Excel* what to do when the user chooses the new command. It tells *Excel* to execute the macro found at the range named OpenSpecial on the macro sheet named OPENSPEC.XLA. We'll look at that macro in a moment. First, note that this is the one place on the macro sheet where the name of the sheet itself is specified. If you use a different name for your macro sheet, be sure to modify cell O2.

Cell Q2 tells *Excel* to display the words "Open a non-Excel file" on the status bar at the bottom of the screen, whenever the user highlights the Open Special command. This part of the command specification is optional, but if you include it, it must be separated by one column from the cell that identifies the command's macro. That intervening column, column P in this case, is a placeholder provided for compatibility with *Excel*'s Macintosh version.

The last cell in the range named open_spec is also optional. It lets you include custom help text with your custom commands. We'll omit it for this simple file-opener command.

Now on to the macro named OpenSpecial, which is listed in Figure 3. This macro begins by calling a custom dialog box named `mydialog`. The code for the dialog box is listed in Figure 4.

Like the range named open_spec, the dialog box range includes some descriptive labels for clarity. The text in E1:L1 and E2:E12 is ignored by *Excel*. It isn't (and must not be) included in the name `mydialog`. The name `mydialog`, then, extends from F2:L12. Another name, `result`, has been assigned to cell L5.

The dialog-box definition includes seven columns of numbers and text. For each element of the dialog box, these columns specify the type of element, the element's horizontal and vertical position, the width and height of the element, any text associated with the element, and the initial value assigned to the element (if any). You can find a list of element-type numbers for *Excel*'s dialog boxes on pages 634 to 638 of the *Microsoft Excel User's Guide* (for Version 3.0).

The last column, the column labeled Init/Result, is also the place where *Excel*

OPENSPEC.XLA E1:L12

	E	F	G	H	I	J	K	L
1	DefTable	Item	X Pos	Y Pos	Width	Height	Text	Init/Result
2	Dialog box				320	144		
3	Title text	5	10	6			Open Special	
4	Group box	14	10	24	200	111	&File type	
5	Button group	11						1
6	WK1 button	12					WK&1 file	
7	WK3 button	12					WK&3 file	
8	TXT button	12					&TXT file	
9	Excel button	12					E&xcel file (*.XL?)	
10	"Other" butt	12					&None of the above	
11	OK	1	214	50	88		OK	
12	Cancel	2	214	74	88		Cancel	

Figure 4: The range of OPENSPEC.XLA that contains the dialog box definition.

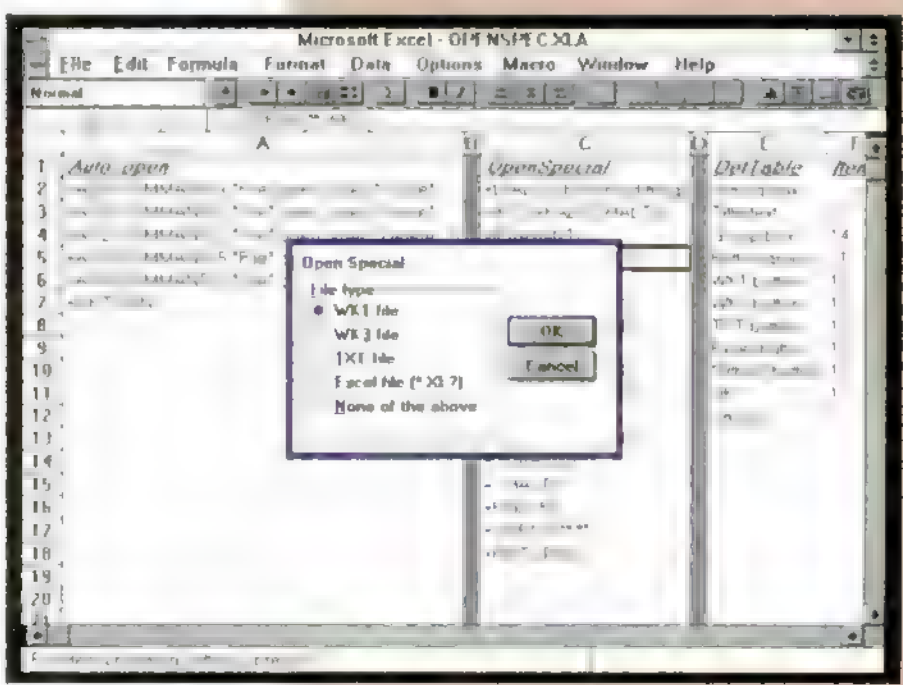

Figure 5: The dialog box presented by OPENSPEC.XLA.

records what the user does with the dialog box. In our file-opener dialog, the user will select an option from the option-button group (the element specified in row 5 of the table); the user's choice will be recorded in cell L5—1 for the first option (WK1), 2 for the second (WK3), and so on. Because the option-button group's initial setting and result are both stored in the same cell, the choice made each time the command is used becomes the default choice for the next use. (Your macro could override this, of course, by explicitly initializing cell L5 on each run—but there's no need to do that here.)

If you want to modify the file-type options presented by your dialog box, change the text in K6:K10, and then modify the OPEN? statements in C5:C17 (to which we'll come momentarily). If you want to add options, insert new rows between rows 6 and 10, enter new items similar to the ones already in the range E6:K10, and then increase the height dimension specified in J4. (Incidentally, the position and dimension specifications in this dialog box are appropriate for the standard Windows VGA driver. If you use a different display driver, you may need to tinker with all these numbers.)

Meanwhile, in the macro named Open-Special, the instruction at C3 provides an exit in case the user clicks on the dialog's Cancel button. In this eventuality, the DIALOG.BOX instruction at cell C2 returns FALSE. Cell C3 then notes the FALSE outcome and ends the macro.

If the user clicks OK, the macro proceeds to an IF...ELSE.IF...END.IF construction, which gets the value of `result` (L5) and issues an OPEN? command with the appropriate wildcard specification. If you modify the dialog box to present different wildcard options, be sure to change this area of the macro to match the new choices.

HINTS, TIPS, QUESTIONS

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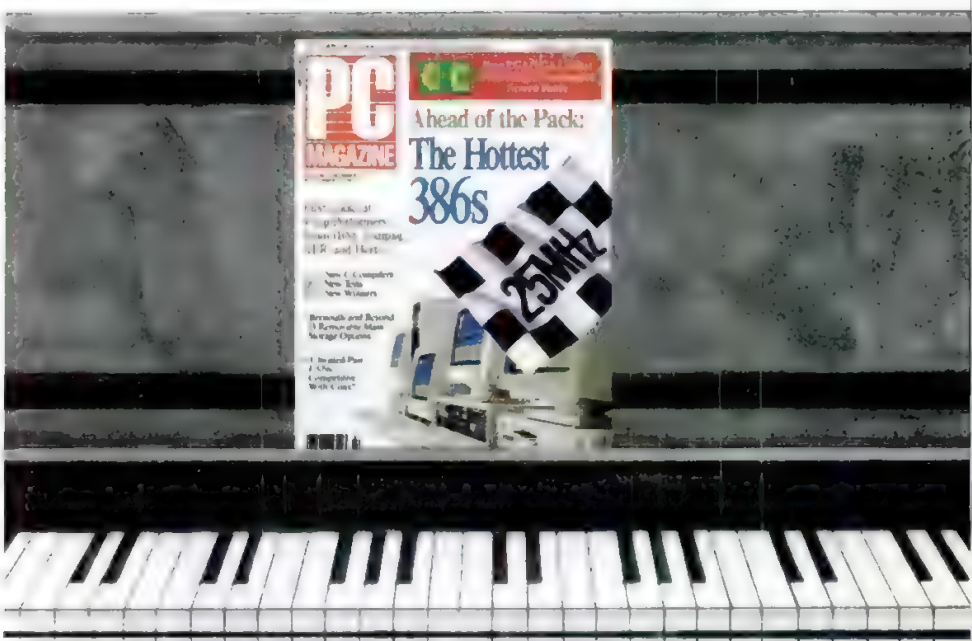

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by
Frank J. Derfler, Jr.

Connectivity

MIXING NETWORKS AND WINDOWS

I received three letters recently from readers uneasy with the idea of installing Microsoft Windows on networked PCs.

Frankly, I didn't understand the problem. I've run Windows on PCs attached to networks using Novell's *NetWare* 3.1*x*, *NetWare Lite*, Artisoft's *LANtastic*, and Performance Technology's *PowerLAN*. From what I've seen, you can load and go, given enough RAM. Often you'll need the latest version of your particular operating system's drivers (with *NetWare*, check for a date of 5-01-90 or later on FILER.EXE and SYSCON.EXE) but that's just sound operating procedure.

All you have to do is start the Windows SETUP.EXE program with its /N switch to initiate a network installation and choose where you want files stored. You might not want SETUP.EXE to modify the path in your AUTOEXEC.BAT file if you make other path changes in a log-on script. I had thought the installation was pretty easy—until I attented a users' conference in Washington, D.C.

We load applications on the local hard disk of every networked PC instead of on the server. This eliminates problems such as large program overlays—particularly from word processors—being read across the network. It reduces LAN traffic and generally leaves the network with more room to grow. And users can keep working even if the network goes down. Space on local disks should present less of a problem than in the past, since now even laptops come with 80MB of storage; it's also easy to upgrade older PCs with inexpensive drives.

The drawback of keeping applications local is that it results in different versions on different PCs. It's far easier to update a program when everyone shares the same version located on a single file server.

The major challenge in combining Windows with applications stored on the server comes from the Windows .INI files. These contain information about software, environment settings, and the hardware for PCs running Windows—elements that often vary from machine to machine. As a result, the files tend to be unique to each PC. They can also grow complex due to the type of data they track. For a good explanation of these files and an excellent utility to set them up, see the Utilities column in the May 28, 1991, issue.

- **MIXING NETWORKS AND WINDOWS: Installing Windows on a network can prove harder than it looks.**
- **3270 EMULATION USING MINIMAL RAM: Stiff competition between vendors of 3270 emulation solutions results in products that conserve your DOS memory.**

Typically, installation routines for Windows applications make changes to the Windows .INI files and create their own as well. If you choose to install a Windows application on the server rather than locally, only the PC used to perform the installation will have its .INI files properly modified. The administrator must then manually change the .INI files for all other networked PCs that will use that application.

WinEase, from a company called CCI, automatically customizes .INI files on each workstation for the roughly 20 applications it recognizes. Every PC on the LAN gets a copy of the product. After installing a new Windows package on the server, the administrator notifies potential users via e-mail. Those interested first start *WinEase* by double-clicking on its icon, then select the desired application from the list presented, causing *WinEase* to modify the appropriate .INI files.

LAN administrators can customize *WinEase* for individual networks by setting default locations for the Windows applications. A large WIN.INI file can affect Windows' performance, so *WinEase* allows users to remove unwanted sections and completely delete application .INI files. Check with CCI to make sure *WinEase* supports the applications you want to run by calling 800-466-4686 or 404-992-8430.

3270 EMULATION USING MINIMAL RAM

I work for an insurance company employing over 1,500 people. We need to connect PCs on our Token-Ring LAN with mainframes running in a mixed operating environment consisting of TSO, CICS, and VM. Users must access graphics applications executing on the mainframes. Can you recommend a 3270 terminal emulator that demands little memory and has graphics capabilities?

Mike Morales
Philadelphia, Pennsylvania

PC MAGAZINE Companies actively marketing 3270 terminal emulators are highly competitive. Vendors like DCA and Attachmate Corp. assure us that their products can take advantage of DOS 5.0 or *QEMM* to put the emulation software into high memory. Zephyr Development Corp. impressed us with a solution that claims only 3.5K of low memory. Although its optional APA graphics package takes an added 150K of RAM, you can unload it when you no longer need it. Contact Zephyr at 713-623-0089.

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by
Bob Ostrander

PC MagNet

KEEPING YOUR MIND SHARP

There's a new wave in computer games: They're called *logic games*. These are more entertaining than arcade games in the long run, because you never run out of challenges. Figure 1 gives filenames and the download libraries where you can find them on PC MagNet.

The numerous *Tetris* and Nintendo lookalikes for the PC tend to fade, as they require fast action, not lots of thought. Those games mainly present you with a physical challenge. Your eye/hand coordination is the only thing involved.

One of the best of the new logic-based games is an introductory-level one called *Tear Down the Wall*. It tests your visual perception skills as you play against the computer to pull bricks out of a wall. The score is based on how many bricks fall when you remove key supporting bricks.

Stained Glass is an update on the old *Dr. I.Q. Jump* game using a 6-by-12 grid and colored panes of glass in primary and secondary colors. It's a simple concept that uses just four sensible rules. When you jump a purple square with a red one, the red gets picked up from the purple and turns into a blue square. It sounds simple, but it is horrifyingly tough to win.

■ KEEPING YOUR MIND SHARP: Test your logic skills with the new variety of computer games on PC MagNet.

Solitaire games come in all sizes and shapes. Microsoft Windows even comes with a pretty good solitaire game.

If you like the Windows Solitaire game (and who doesn't) be sure to try *Calculation Solitaire for Windows*. In *Calculation Solitaire*, the four stacks are built in the patterns 1–2–3, 1–3–5, 1–4–7, and 1–5–9, which requires much more planning than the regular game.

If you don't like that one or don't use Windows, try the *Patience* solitaire set, with ten different variations of solitaire combined into one program. You can also try the standalone *Klondike* and *Pyramid* variations. They are flashy, and have an easy-to-use interface.

The variety of solitaire games is seemingly endless. Some aren't even based on cards. The original *EGA Mah Jongg* solitaire challenges you to remove matching pairs of Chinese picture tiles that are free on the edges of a stack—very tough to tear yourself away from.

This negative productivity tool has been cloned for the VGA, and there are many versions now, including a Windows version called *Taipei*.

Another Windows game that will exercise your mind is *Backgammon*. It is programmed to play a fairly good game with intelligent doubling.

Possibly the best all-time logic games that combine a little luck with the action are those in the *Landmine* genre. You are at one end of a minefield with a detector that tells you only how many total mines are in the surrounding squares. If it reads 0, you can move in any direction, otherwise you need to move around to figure out which adjoining spaces have mines. Sometimes you just have to trust your luck and make a move into unknown territory; this adds to the thrill of making it across safely. There are various versions available, including the original *Landmine* and *Windows Mines*.

One last category of games good for your mind are word games. The best of these might be *Jotto*. It is somewhat like *Mastermind*, but played with five-letter words. The object, of course, is to guess the opponent's (in this case the computer's) word first by eliminating letters from words that you guess. The massive built-in dictionary in this game can be used by you as well as by the computer. I used to play this when I was a kid—with my mom rather than a computer—and look what it got me: a job as a writer.

A good game is one that you feel guilty about playing. A great game will have you making excuses to yourself about playing when you should be working. ■

GAMES ON PC MAGNET

Filename	Forum	Size	Program
CLCSOL.ZIP	AFTERHOURS Lib 3	70K	*Calculation Solitaire* (ASP shareware, $15)
JOTTO.ZIP	PBS Lib 13	122K	*Jotto* (shareware, $10)
KLONDI.ZIP	PBS Lib 13	130K	*Klondike Solitaire* (ASP shareware, $15)
LANDMN.ZIP	PBS Lib 13	19K	*Landmine* (bannerware/freeware)
MAHJNG.ZIP	PBS Lib 13	143K	*EGA Mah Jongg* (ASP shareware, $15)
MJVG-1.ZIP	PBS Lib 13	125K	*VGA Mah Jongg* (ASP shareware, $15)
MJVG-2.ZIP	PBS Lib 13	159K	
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Figure 1: This table will help you locate logic games on PC MagNet. Just look for these filenames in the corresponding download libraries.

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CIRCLE 350 ON READER SERVICE CARD

by
Douglas Boling

Utilities

WINPTR Lets You Find Your Windows Cursor on a Laptop

With today's laptops, there's no problem finding the power to run Windows. The problem is finding the cursor when you *do*. That crucial little arrow simply seems to disappear on laptop LCDs, which still lack the speed and contrast to handle the complex details of the Windows GUI (graphical user interface).

WINPTR will restore your Windows cursor visibility, highlighting the pointer so it stands out clearly on dim, washed-out LCD screens. In addition to using it on laptops, you can also use WINPTR for presentations on large-screen projectors. Even on a desktop machine, it can help people who just can't find that little arrow amid all the clutter on their screen.

To accommodate different display needs and personal tastes, WINPTR offers a variety of highlighting methods, from large enclosing blocks to subtler under-arrow bars, in both regular and reverse video. The enhancement turns on only after a quick cursor movement, and both the duration and the movement sensitivity are adjustable. Like every good Windows program, WINPTR remembers the settings you gave it the last time it was run.

You can download WINPTR.ZIP, which includes the necessary WINPTR.EXE and WINPLIB.DLL files from PC MagNet, by following the instructions given in the "Downloading Utilities" sidebar. The C source code can also be downloaded in WINPTR.ZIP, together with the .RC, .CUR, .ICO, .DEF, and .MAK files necessary to compile the program. Compilation requires the Microsoft C 6.0 Compiler along with the Windows Software Development Kit (SDK). While the program was developed using Microsoft C, it can be easily ported to Borland's excellent Borland C++ compiler.

If you don't have a modem, you can request the WINPTR source files by mail or fax. Simply send a postcard with your name and address or fax number to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; no phone calls, please!

■ If you're out on the road and you can't see the cursor on your laptop when Windows is running, WINPTR is one utility you won't want to be without.

USING WINPTR

In order to use WINPTR, you must put WINPTR.EXE and WINPLIB.DLL either into your Windows directory or into a directory listed in your PATH statement. To take the program for a test drive, simply select File Run from the Program Manager menu and enter WINPTR. If you want to keep the utility immediately available, you can add it to a Program Manager group from the File New menu. If you decide you want to start WINPTR automatically each time you start Windows, you can put WINPTR in the LOAD= line of WIN.INI.

WINPTR has one optional command line argument. When the program detects a /i on the command line, it automatically minimizes when it starts. Automatic minimization is handy if you don't need to change WINPTR's settings since the last time you used the program. Using the /i parameter is unnecessary if you load WINPTR on the LOAD= line, since such programs are minimized automatically.

When you launch WINPTR, a small dialog box containing a few easily understandable controls will appear. Cursor highlighting is immediately enabled, as you'll see when you move the cursor rapidly across the screen. You can see the dialog box and highlight in Figure 1. The original cursor arrow will be replaced by an arrow with a large square black background. As your movements become smaller and more delicate, the cursor will be restored to its original shape.

Next, move the cursor quickly to a window border. You'll notice that the highlighted cursor now becomes a four-way size arrow rather than the standard "11 o'clock" pointer. This tells you when you can grab the edge of a window even if the cursor is highlighted.

The controls in the dialog box let you modify WINPTR's settings. The first control is a button that simply toggles between enabling (the default) and disabling the highlighting. The two sensitivity controls are scroll bars. The Movement Trigger scroll bar sets the number of pixels the cursor must travel in a single motion before WINPTR highlights the cursor. The adjustment range is from 0 to 600 pixels. Note that the higher you make this setting, the more radical the mouse movement must be before cursor highlighting kicks in. (This point will be reached more quickly on fast laptops than on slow models.) Setting the movement trigger to 0 causes the cursor to be highlighted continuously.

The other scroll bar, labeled Persistence Time, adjusts the time the cursor highlighting remains in effect after it is switched on. Keeping the highlight on briefly ensures that you won't lose sight of the cursor as you slow down to a stop on the screen. The remain-on time can be

adjusted from 0 to just over 4 seconds. A Persistence Time setting of 0 causes WINPTR to immediately change back to the original cursor as soon as the movement of the cursor slows to less than the setting of the Movement Trigger. A 4-second Persistence Time keeps the cursor highlighted even after several seconds of nonuse.

The shape of the highlighted cursor can be selected by repeatedly pressing the Set Pointer button. Ten cursors are available for selection, ranging from a white arrow on a black background to the standard cursor arrow highlighted by a small underline. The cursor shape, persistence, and movement values are saved for reuse the next time the program is activated.

The remaining control buttons in WINPTR call up a help screen and exit the program. The help screen briefly describes the Movement Trigger and Persistence Time. It also displays general information about the program, including the author and copyright notice. Cursor highlighting is disabled if you press the Exit button.

HOW WINPTR WORKS

While WINPTR is in many ways a typical Windows program, it does have a few unusual features worth discussing. One is that it uses a modeless dialog box as its primary window. Another notable feature is that WINPTR's functions are actually divided into two files, the executable file and a dynamic link library file called WINPLIB.DLL. Using a dynamic link library file is necessitated by the final unusual feature of WINPTR, its use of a systemwide hook into the Windows Message queue.

Without the need for code to manage the controls, WndProc is actually quite simple.

As with most Windows programs, WINPTR comprises two main routines. WinMain is the entry point into the program. WinProc embodies the procedures that process the numerous messages sent to the program. You can see the first departure from the normal Windows practice when WINPTR registers the window class of the dialog box. The cbWndExtra field of the `wndclass` structure is set to the predefined DLGWINDOWEXTRA value. This is necessary so that Windows can process the window class being registered as a dialog box. Another difference appears immediately after the window class is registered. Instead of making the standard CreateWindow call, WINPTR uses a CreateDialog call to create the main window.

After the window is created, WINPTR checks to see whether the user has requested that the program start with a minimized window. The lpszCmdParm parameter is a pointer to the command line of the program. WINPTR checks to see if the first character on the command line is a - or /, which would indicate the presence of a command-switch parameter. If so, the character after the switch character is checked to see if the parameter is an i. If the user requests minimization, the nCmdShow parameter is ORed with the SW_MINIMIZE value to ensure that the window will be minimized when it is shown.

WINPTR uses a dialog box instead of a standard client window as its main window because of the number of buttons and scroll bars. Each control in the WINPTR window is a child window that must be created and positioned. Since Windows itself manages the controls for dialog boxes, using a modeless dialog box means WINPTR doesn't have to manage those child windows. Without the need for code to manage the controls, WndProc is actually quite simple. As with any other dialog box, the controls are positioned using a dialog box template in the .RC file. Although WndProc works like a DialogProc, there are a few differences.

One difference between a standard dialog procedure and WndProc is the lack of a WM_INITDIALOG message. At the time the standard WM_CREATE message is sent to the procedure, the control windows have not been created. This obviously means that the initial values of the controls cannot be set at that point. To get around this difficulty, WINPTR initializes the controls during the WM_SIZE message. Even though the WINPTR dialog box is not sizable, the WM_SIZE message is sent to WndProc when the window is first created and whenever the window is restored from an icon.

Like standard dialog box procedures, WinProc does not process the WM_PAINT message. Since the client window contains only controls, there is no need to paint the window. Unlike a dialog procedure, however, the messages not processed by the window procedures are passed to the default window procedures, DefWindowProc, not to DefDlgProc, the default dialog procedures.

The remainder of WndProc deals with responses to the window controls. Clicks of the four buttons are processed in the WM_COMMAND message, and the wParam parameter is used to determine which button was pressed. The Help button is processed by displaying the help dialog box. The Exit button is processed by sending a WM_QUIT message back to the window. The other two buttons, Enable/Disable

Figure 1: This Windows screen shows the dialog box presented by WINPTR along with one of its cursor highlights.

and Set Pointer, are handled by calling routines in the DLL module.

Changes in the scroll bars are processed through the WM_HSCROLL message. To process the WM_HSCROLL message, WndProc determines the new value of the scroll bar (using the GetScrollPos call), updates the position of the scroll bar thumb, and then sends the new values for the movement and time triggers to the DLL. The text above the scroll bar is then changed using a SetDlgItemText call.

Although a scroll bar is generally an excellent control for specifying ranges to a program, its linear entry mode can cause problems. In order for a scroll bar to cover a large range (for example, from 0 to 1000), the incremental movement to change from 0 to 1 must be very small.

To allow for precise movements among low values while retaining a large range, WINPTR modifies the values entered by the scroll bars. The scroll values are queried from the controls using the normal method of calling the GetScrollPos function. Once the value is retrieved, it is scaled if the value is past the halfway point in the range.

Thus, for example, the Move Trigger scroll bar is actually initialized with a range from 0 to 200, while the range perceived by the user runs from 0 to 600. This is done by the following line of C code in the WM_HSCROLL routine:

```
if (i > 100) i = 100 + ((i - 100
 * 5);
```

In this way, if the value from the Move Trigger scroll bar is above 100, each increment above 100 is multiplied by 5. This allows the Move Trigger scroll bar to retain fine control over the important low values while still providing a large overall range. The Persistence Time is similarly scaled, though with different parameters.

The user-specified Movement Trigger, Persistence Time, and highlighted-icon-shape parameters are saved in a private profile file with the name WINPTR.INI. This file is queried during the WM_CREATE message, and the GetPrivateProfileInt function is used to retrieve the values. The values are set during the WM_DESTROY message, using the WriteProfileString function. By using these two functions, the job of opening, reading or writing, and closing the file is performed by Windows.

THE SETLOCATE ROUTINE

```
BOOL FAR PASCAL SetLocate (BOOL bEnable) {
        static FARPROC lpfnNextHook;

        if (bEnable) {
                if (ucHooked == 0) {
                        lpfnNextHook = SetWindowsHook (WH_GETMESSAGE,
                                GetProcAddress (hInst, "MsgHookProc"));
                        ucHooked++;
                }
        } else {
                if (ucHooked != 0) {
                        SetWindowsHook (WH_GETMESSAGE, lpfnNextHook);
                        ucHooked--;
                }
        }
        return TRUE;
}
```

Figure 2: The SetWindows hook function is called with the WH_GETMESSAGE parameter to specify that WINPTR is setting a GET MESSAGE hook. Other hooks are also available.

THE DLL CODE

While the .EXE file deals with the user through the window controls, the DLL code does the real work of the program—highlighting the cursor. A DLL is simply a collection of callable routines linked to the program when it is run, not when the program is created. WINPLIB.DLL contains the routines that perform such functions as initialization, querying and setting variables in the DLL, and, of course, changing the Windows cursor.

Just as a standard Windows program has a WinMain routine that is the entry point to the program, DLLs also have an entry point that is called when the DLL is first loaded. This initialization routine, called LibMain, provides a handy place in which to perform any initialization of data in the DLL before the other routines are called. In WINPLIB.DLL, the LibMain routine loads the highlighted cursor and other cursor handles used by the DLL. The routine then returns with a value of 1, which indicates that the DLL has been successfully initialized.

Another routine, WEP, is called when the DLL is removed from memory. A DLL is removed from memory after the last program that requires it terminates. In WINPLIB.DLL, when the WEP routine determines that the message hook is in place, it removes the hook routine from the chain. Three DLL functions, GetStatus, SetCursorID, and SetTriggers, are called by the .EXE file to pass parameters and to get data from the DLL. SetTriggers passes new movement and time triggers to the DLL. The routines simply copy the values passed by the .EXE file to global variables in the DLL's data segment.

The SetCursorID function tells the DLL which of the stored cursor images to use as the highlighted cursor. When called, the routine uses the parameter passed to load the proper cursor from the resource file of the DLL. The GetStatus function returns a structure that contains the current movement trigger and Persistence Time as well as the cursor ID stored in the DLL.

To control the cursor highlighting, the .EXE calls the SetLocate function (see Figure 2). When called with bEnable TRUE, the SetLocate function calls the SetWindowsHook function to install the Hook function into the message queue. The SetWindowsHook function returns a pointer to the function that was the previous hook routine. This pointer is used so that the previous function can be called after the Hook function completes its processing.

If bEnable is FALSE, the SetWindowsHook function is also called, this time to unhook the hook function from the chain. The SetWindowsHook function is called with the previous hook function pointer as its argument. This restores the original destination in the hook chain, removing the WINPTR Hook function from the chain.

The Hook function itself contains the code that actually changes the Windows cursor. Changing the shape of the cursor is done simply by calling the SetCursor function. It is determining when to change the cursor that is the interesting part of the DLL.

The movement of the cursor is monitored by hooking into the system message queue and monitoring all the mouse move messages. Each time the user moves

the mouse, one of two messages, WM_MOUSEMOVE (if the mouse is in the client window) or WM_NCMOUSEMOVE (otherwise) is sent to the window that has the input focus. With the System Message Hook in place, WINPTR (or, more precisely, the WINPLIB.DLL) is called each time any program in the system calls the GetMessage function. Since the GetMessage function is used by all Windows programs to retrieve messages from the system message queue, WINPTR thus monitors all messages—including the mouse move messages—in the system.

Before Windows sends a message to any application, it calls the Hook function, giving it a *pointer* to that message. The message structure contains the message, the accompanying wParam and lParam values, the position of the mouse when the message was sent, and the time of the message. The WINPTR Hook function checks the message to see if it is one of the two mouse movement messages. If it is, the Hook function compares the mouse position in the message structure with the position of the mouse at the time of the last mouse move message. If the difference in positions is larger than the Movement Trigger value, a time value stored in the DLL is set to zero.

A DLL has only one data segment no matter how many programs call it.

For any message, mouse move or other, the Hook function checks the timestamp of the message with the time value stored in the DLL. If the difference in the times is less than the Persistence Time, then the Hook function changes the cursor to the handle of the highlight cursor by using the SetCursor function.

WINPTR changes the cursor to one of two highlighted shapes, a highlighted arrow, or a highlighted sizing arrow. To determine which cursor highlight to use, HookProc compares the handle of the pointer returned by the SetCursor function. The handle returned is the handle of the previous cursor. If the previous cursor handle is not the arrow cursor, the handle is compared with the different sizing cursors used by Windows. If the previous cursor was a sizing cursor, SetCursor is called again to use the highlighted sizing cursor.

DLL PROGRAMMING

Using a DLL has many advantages. For one thing, by isolating useful routines in a DLL, multiple programs can call them, thus reducing the memory required for the programs. In fact, most of Windows' system functions are in the form of DLL modules. The second advantage of DLLs is their isolation from the executable programs. Windows programs can call DLLs that were written by different programmers or that were even developed by different companies.

While the DLL is thus a very useful concept, programming DLLs is subtly different from programming a standard .EXE program. You must keep these differences in mind when writing the requisite .DEF and .MAK files as well as when writing the .C file code itself.

Two of the major differences between .EXEs and DLLs involve the DLL data segment. When more than one copy of a program is running, Windows keeps separate data segments for each instance of the program. This allows each copy of the program to act as if it were the only copy of the program running. A DLL, on the other hand, has only one data segment no matter how many programs call it. A big advantage of using a single data segment is that the DLL becomes a convenient way to pass data from one program to another. The first program calls a function to set a value in the DLL; the second program then calls a function to retrieve that data.

A disadvantage of the single data segment, however, is that programs cannot rely on data stored in a DLL to remain constant. For example, while one program may pass a value to the DLL, another program can call the same function to change that value. Programs cannot simply keep duplicate values of the DLL data on the assumption that it will stay the same. Every time a program wants to use DLL data, it should request it.

Another big difference between DLLs

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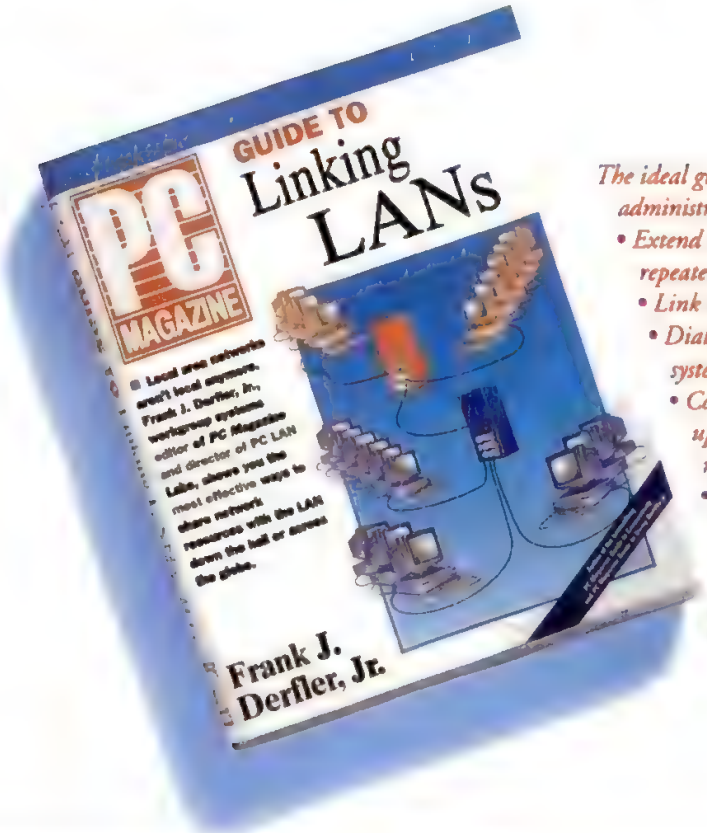

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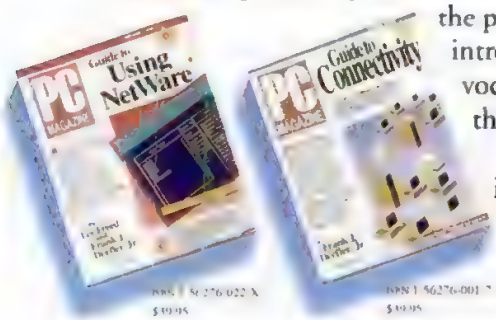

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and .EXEs arises from that favorite of programming issues, the Intel segmented architecture. Most Intel processors have four segment registers: the code segment, where the executable code resides; the data segment, where the data for the program is stored; the stack segment, where the stack data is stored; and the extra segment, which is usually used as an additional data segment. In Windows programs, the stack is contained in the data segment, so the data segment register DS is equal to the stack segment register SS.

Since DLLs are simply a collection of routines called by other programs, DLLs use the stack of the calling program. However, since DLLs have their own data segment, the stack segment is no longer equal to the data segment. This is important, for most high-level languages use the stack to store temporary variables for a routine, while permanent variables are stored in the data segment. This means that the data for a DLL routine is divided between two different segments. This presents a problem for most C compilers used to write Windows programs.

To guard against wrong assumptions made by the Microsoft C Compiler, an additional switch (-ASw for small model DLLs) is set when the DLL is compiled. This switch informs the compiler that the code being compiled is a DLL and that SS is different from DS. The compiler then keeps track of the locations of different variables. In places where the compiler cannot determine the proper segment, a warning message is displayed during the compile.

Just as DLLs use different compile options, they must also be linked in a manner different from normal Windows executable files. The normal linking process for Windows programs includes linking in special header code for each of the external entry points of the program. External entry points in DLLs also need special header code, but the code linked is different for DLLs. When linking a DLL, the object library LIBENTRY must be linked to the DLL. LIBENTRY contains the DLL initialization code necessary for code compiled by the C compiler. The standard library is not the usual SLIBCEW, but SDLLCEW. The different standard library is needed to take into account the DS != SS issue.

The differences between .EXE files and DLLs also extend to the .DEF file. Each of the routines in the DLL that can be called must be declared as an exported function in the DLL's .DEF file. The .DEF file contains instructions to the linker so that it can create the proper prefix code for the externally callable routine. The prefix code is responsible for setting the proper values of the segment registers when the routines are called.

Windows programming is able to ignore the dreaded 640K DOS limit.

.DEF file changes must also be made to programs that call DLLs. To call a routine in a DLL, that routine must be listed in the IMPORTS section of the .DEF file for the program. The name of each routine to be called must be listed, together with the name of the DLL in which the routine resides.

The association between DLL routines and program calls can be made in the .DEF file by another method. Instead of listing the names of the DLL routines, the routines can be referenced by number. Referencing routines by numbers, called *ordinals*, reduces the size of the .EXE file. WINPTR uses the ordinal method of referencing the DLL routines.

CODE SIZE

Windows programming enjoys the luxury of being able to ignore the dreaded 640K DOS limit. This does *not* mean that a Windows program can be casual about memory consumption, however. Since WINPTR will usually be running throughout an entire Windows session, an effort was made to make WINPTR use as little memory as possible.

The best way to reduce memory usage would be to write WINPTR in assembly language. But while this would certainly minimize code size, programming Windows code in assembly language is a task best left to those who enjoy pain. For the rest of us, other code-minimization methods must be used.

One easy method of reducing code size in a C program is to eliminate any extraneous calls to the C library functions. Fortunately, WINPTR is a simple program that uses only three of the standard library functions: STRCPY, STRCAT, and ITOA. To eliminate linking to the C libraries, those three functions were written directly into the WINPTR code as routines.

Since WINPTR doesn't make any calls to the C library, the C library start-up code that is normally automatically linked into a C program can also be eliminated. This is done by linking in the SNOCRT library instead of the SLIBCEW library. (Both of these names specify the small model libraries that would be used in a small model program such as WINPTR.) The SNOCRT library contains the necessary Windows prefix code without the unnecessary standard library initialization code. The size of the DLL code can also be reduced by eliminating the standard C library. Thus, the WINPTR DLL, WINPLIB, links in the SNOCRTD library instead of the SDLLCEW library.

Having eliminated the standard libraries, and taking into account the fact that WINPTR makes no local memory allocations, the heap size for both the .EXE and .DLL files can be set to 0. This reduces the size of the data segments that WINPTR uses. The .EXE data segment will still be at least the size of the STACKSIZE parameter in the .DEF file, however, since the stack is contained in the local data segment.

By using all these memory reduction techniques, memory consumption of the DLL WINPLIB was reduced from 1,088 to 960 bytes for the code and from 1,280 to 96 bytes for the data segment. The .EXE file memory requirements were reduced from 3,232 to 1,824 bytes for the code segment and from 9,984 to 8,480 bytes for the data segment. Thus the memory reduction techniques reduced the overall memory consumption of WINPTR by 22 percent, and the memory consumption of WINPLIB was reduced a whopping 55 percent.

The logic to implement WINPTR is conceptually simple. It is the need to deal with the Windows memory management system that is difficult. However, despite having to move the Hook code into a separate DLL file, WINPTR remains a simple Windows program. Even when dealing with Windows and the special needs of laptop users, simplicity is no bar to usefulness. ■

Douglas Boling is a contributing editor of PC Magazine.

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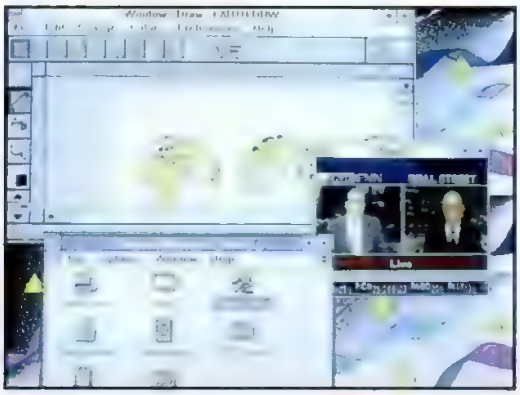

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by
Charles Petzold

Environments

An Introduction to The Musical Instrument Digital Interface

The Musical Instrument Digital Interface (MIDI) is a protocol for connecting electronic musical instruments among themselves and with computers. It was developed in the early 1980s by a consortium of manufacturers of electronic music synthesizers.

At first MIDI seems as if it must be very complex. But as you become familiar with it, you realize it's a lot simpler than you might initially imagine. Then, as you get to know even more about MIDI and everything it can do, it starts to seem somewhat complex again.

MIDI is an extremely important standard in the area of electronic music. Any PC multimedia environment simply must support MIDI, and that includes the Multimedia Extensions to Microsoft Windows. In the months ahead, I'll discuss how MIDI support is implemented in Multimedia Windows.

WHAT MIDI IS AND IS NOT

MIDI defines a protocol for passing digital commands along a cable. MIDI cables use 5-pin DIN connectors, but only 3 of the pins are actually used. One is a shield, one is a current loop, and the third carries the data. The MIDI protocol is unidirectional at 31,250 bits per second. Each byte of data begins with a start bit and ends with a stop bit, for an effective transfer rate of 3,125 bytes per second.

What's important to understand is that no actual sounds—in either an analog or digital format—are transferred through the MIDI cable. This is a common misconception, and the primary reason why MIDI seems more complex than it actually is. What travels through the cable are generally simple messages, usually 1, 2, or 3 bytes in length.

THE SIMPLEST CONFIGURATION

Perhaps the simplest type of MIDI configuration is shown in Figure 1. You begin with two pieces of MIDI-compatible hardware. One is a MIDI keyboard that makes no sounds by itself but serves solely to generate MIDI messages. This keyboard has a MIDI port labeled "MIDI Out." You then connect a MIDI cable from this port to the MIDI In port of a MIDI sound synthesizer. This synthesizer may simply look like a little box with a few buttons on the front.

> ■ MIDI defines a standard for passing digital commands along a cable to connect electronic musical instruments with computers. These commands aren't the sounds themselves, but messages that control the synthesizers that produce the sounds.

When you press a key on the keyboard (for example, middle C), the keyboard sends 3 bytes to the MIDI Out port. In hexadecimal, these bytes are 90 3C 40. The first byte (90) indicates a "Note On" message. The second byte is the key number, where 3C is middle C. The third byte is the velocity with which the key is struck and may range from 1 to 127. We happen to be using a keyboard here that is not velocity-sensitive, so it sends an average velocity value.

This 3-byte message goes through the MIDI cable into the MIDI In port of the synthesizer. The synthesizer responds by playing a tone at middle C.

When you release the key, the keyboard sends another 3-byte message to the MIDI Out port: 90 3C 00. This is the same as the first command, but with a 0-velocity byte. This indicates a Note Off command, meaning that the note should be turned off. The synthesizer responds by stopping the sound.

If the synthesizer is capable of polyphony (playing more than one note at the same time), you can play chords on the keyboard. The keyboard generates multiple Note On messages and the synthesizer plays all the notes. When you release the chord, the keyboard sends multiple Note Off messages to the synthesizer.

Generally speaking, the keyboard in this configuration is known as a *MIDI controller*. It is responsible for generating MIDI sequences to control a synthesizer. A MIDI controller does not have to look like a keyboard. There are MIDI wind controllers that look like clarinets or saxophones, MIDI guitar controllers, MIDI string controllers, and MIDI drum controllers. At the very least, all of these controllers generate 3-byte Note On and Note Off messages.

Rather than resembling a keyboard or a traditional music instrument, a controller can also be a *sequencer*, a piece of hardware that stores sequences of Note On and Note Off messages in memory and then plays them back. Standalone sequencers are used much less today than they were some years ago because they have been replaced with computers. A computer equipped with a MIDI board can also generate Note On and Note Off messages to control synthesizers. MIDI authoring software (which lets you com-

pose on-screen) can store MIDI messages coming from a MIDI controller, lets you manipulate them, and then sends the MIDI messages to a synthesizer.

The synthesizer is sometimes called a *sound module* or *tone generator*. MIDI does not specify how the sounds will actually be generated. The synthesizer could be using any one of a variety of different sound generation techniques.

THE PROGRAM CHANGE

What kind of sound does the synthesizer actually make? Does it sound like a piano? A violin? A trumpet? A flying saucer? Generally the various sounds a synthesizer is capable of producing are stored in ROM or somewhere else. These sounds are called *voices, instruments*, or *patches*. (The word *patch* comes from the days of analog synthesizers where different sounds were configured by plugging patch chords into jacks on the front of the synthesizer.)

In MIDI, the different sounds a synthesizer can produce are known as *programs*. Changing the program requires sending the synthesizer a MIDI Program Change message: C0 *pp*, where *pp* can range from 0 to 127. Often a MIDI keyboard will have a series of numbered buttons across the top that generate Program Change messages. By pressing the buttons you can control the synthesizer voice from the keyboard. The numbering of these buttons usually begins with 1 rather than 0, so program number 1 corresponds to a Program Change byte of 0.

The MIDI specification does not stipulate which program numbers correspond with which instruments. For example, the first three programs on a Yamaha DX7 synthesizer are called "Warm Strings," "Mellow Horn," and "Pick Guitar," while on a Yamaha TX81Z tone generator, they are "Grand Piano," "Upright Piano," and "Deep Grand." And on a Roland MT-32 sound module, the first three programs are "Acoustic Piano 1," "Acoustic Piano 2," and "Acoustic Piano 3."

So if you don't want to be surprised when you make a program change from a keyboard, you better know which instrument voice corresponds to each program number in your synthesizer.

This can be a real problem for MIDI files (the format of which I'll discuss in a future column) that contain Program Change messages; these files are not device-independent because their contents will sound different on different synthesizers. The MIDI implementation in Multimedia Windows has partially solved this problem; I'll discuss how in a future column.

STATUS AND DATA BYTES

So far I've discussed two MIDI messages. The first is Note On

```
90 kk vv
```

where *kk* is the key number (0 to 127) and *vv* is the velocity (0 to 127). A 0 velocity indicates a Note Off command. The second is the Program Change

```
C0 pp
```

where *pp* ranges from 0 to 127. These are typical of MIDI messages. The first byte is called the *status* byte. Depending on what the status byte is, it is usually followed by 0, 1, or 2 *data* bytes. (The exception is for "system exclusive" messages as I'll describe shortly.) It's easy to distinguish a status byte from a data byte: The high bit is always 1 for a status byte and 0 for a data byte.

THE MIDI CHANNEL

The generalized form of the Note On message is

```
9n kk vv
```

and for the Program Change message it is

```
Cn pp
```

In both cases, *n* corresponds to the lower 4 bits of the status byte and may range from 0 to 15. This is called the MIDI *channel*. Channels are usually numbered beginning with 1, so if *n* is 0, that indicates channel 1.

The use of 16 different channels allows a MIDI cable to carry messages for 16 different voices. Generally, you'll find that a particular string of MIDI messages will begin with Program Change messages to set a voice for the various channels being used, followed by multiple Note On and Note Off commands. Later on there may be other Program Change commands. But at any time, each channel is associated with only one voice.

Let's take a simple example: Suppose the keyboard controller I've been describing is able to generate MIDI messages for two different channels simultaneously—channel 1 and channel 2. You might begin by pressing buttons on the keyboard to send two Program Change messages to the synthesizer:

```
C0 01
C1 05
```

Channel 1 is now set for program 2, and channel 2 is set for program 6. (Recall that channel numbers and program numbers are 1-based but encoded in a 0-based form in the messages.)

Now when you press a key on the keyboard, it sends two Note On messages, one for each channel:

```
90 kk vv
91 kk vv
```

This lets you play two instrument voices in unison.

An alternative is a "split" keyboard. The lower keys could generate Note On messages on channel 1, and the upper keys could generate Note On messages on channel 2. This lets you play two instruments independently from one keyboard.

The use of 16 channels becomes more powerful when you think about MIDI

Figure 1: The simplest type of MIDI configuration consisting of two pieces of MIDI-compatible hardware, a MIDI keyboard and a MIDI sound synthesizer.

sequencing software on a PC. Each channel corresponds to a different instrument. If you have a synthesizer that can play 16 different instruments independently, you can orchestrate a composition for a 16-piece band and connect the MIDI board with the synthesizer using just one MIDI cable.

DAISY-CHAINING

In the real world, very simple MIDI controllers (such as wind controllers) have only MIDI Out cable ports. Often a keyboard will have a built-in synthesizer and it'll have three MIDI cable ports labeled MIDI In, MIDI Out, and MIDI Thru. The MIDI In port accepts MIDI messages to play the keyboard's internal synthesizer. The MIDI Out port sends MIDI messages from the keyboard to an external synthesizer. The MIDI Thru port is an output port that duplicates the input in the MIDI In port: Whatever comes into the MIDI In port is sent back out to the MIDI Thru port. (The MIDI Thru port does not contain any of the information sent out over the MIDI Out port.)

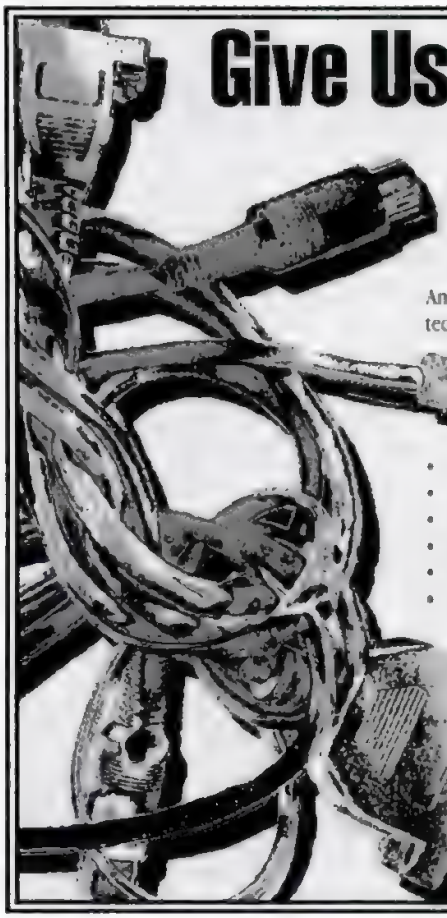
There are only two ways to connect MIDI hardware by cables: You can connect a MIDI Out on one piece of hardware to MIDI In of another, or connect MIDI Thru to MIDI In. The MIDI Thru port allows daisy-chaining MIDI synthesizers. For example, suppose you were orchestrating a 16-part composition on some MIDI software but you're using synthesizers that can play only 4 different voices simultaneously. Fortunately, you have 4 of these synthesizers. You'd wire them up as shown in Figure 2.

Figure 2: This shows a single MIDI board running four synthesizers.

You could also use two keyboards with the same synthesizer. One keyboard generates channel 1 messages and the other generates channel 2 messages. The two cables from the MIDI Out ports of the keyboards are run into a MIDI merger box to synchronize the signals. The result goes into the MIDI In port of the synthesizer.

MIDI MESSAGES

Although the Note On and Program Change messages are the most important in any MIDI implementation, this is not all



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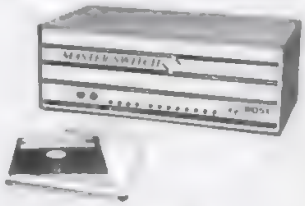

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MIDI CHANNEL MESSAGES

Note Off	8n kk vv	kk = key number (0–127) vv = velocity (0–127)
Note On	9n kk vv	kk = key number (0–127) vv = velocity (1–127, 0 = note off)
Polyphonic After Touch	An kk tt	kk = key number (0–127) tt = after touch (0–127)
Control Change	Bn cc xx	cc = controller (0–121) xx = value (0–127)
Channel Mode:		
Local Control	Bn 7A xx	xx = 0 (off), 127 (on)
All Notes Off	Bn 7B 00	
Omni Mode Off	Bn 7C 00	
Omni Mode On	Bn 7D 00	
Mono Mode On	Bn 7E cc	cc = number of channels
Poly Mode On	Bn 7F 00	
Program Change	Cn pp	pp = program (0–127)
Channel After Touch	Dn tt	tt = after touch (0–127)
Pitch Wheel Change	En 11 hh	ll = low byte (0–127) hh = high byte (0–127)

NOTE: n = channel number, 0–15

Figure 3: This chart shows the MIDI channel messages defined in the MIDI 1.0 specification.

that MIDI can do. Figure 3 shows a chart of the MIDI channel messages defined in the MIDI 1.0 specification. As I've noted above, the status byte always has the high bit set and all data bytes that follow the status byte have a high bit equal to 0. This means that status bytes can range from 0x80 through 0xFF, while data bytes range from 0 through 0x7F.

The key numbers generally correspond to the traditional notes of Western music, although they don't have to. (For a percussion voice, each key number could be a different percussion instrument, for example.) When the key numbers correspond to a piano-type keyboard, key 60 (in decimal) is middle C. The MIDI key numbers extend 21 notes below and 19 notes above the range of a normal 88-key piano. The velocity number is the velocity with which the key is depressed, which on a piano governs both loudness and the harmonic character of the sound. A particular voice can respond to key velocity in this way or other ways.

The examples I showed earlier used a Note On message with a velocity byte of 0 to indicate a Note Off command. There is also a separate Note Off command for keyboards (or other controllers) that implement a key release velocity. This is very rare, however.

There are two *after touch* messages. After touch is a feature of some keyboards where you can change the sound in some way by pressing harder on the key after it's already depressed. One message (status byte 0xDn) is an after touch that applies to all the notes currently being played in a channel; this is by far the most common. The status byte 0xAn indicates a status byte that applies to each individual key independently.

Usually the keyboards have dials or switches for further controlling sound. These are called controllers and any change is indicated by a status byte of 0xBn. Controllers are identified by numbers ranging from 0 to 121. The 0xBn status byte is also used for Channel Mode messages that indicate how a synthesizer should respond to simultaneous notes in the channel.

One very important controller is a wheel that shifts the pitch up and down. This has a separate MIDI message with a status byte of 0xEn.

THE SYSTEM MESSAGES

There is something missing from the chart in Figure 3, and that's messages beginning with status bytes of F0 through FF. These are called *system messages* because they apply to the entire MIDI system rather than a particular channel. System messages typically are used for synchronization purposes, triggering sequencers, resetting hardware, and obtaining information.

Many MIDI controllers continually send out status bytes of 0xFE, which is called the Active Sensing message. This simply indicates that the MIDI controller is still attached to the system.

One important system message is the *system exclusive* message that begins with a status byte of 0xF0. It's used for transferring chunks of data to a synthesizer in a manufacturer-dependent and synthesizer-dependent format. (For example, new voice definitions can be passed from a computer to a synthesizer in this way.) The system exclusive message is the only message that can contain more than 2 data bytes. In fact, the number of data bytes is variable, but each data byte must have its high bit set to 0. The status byte 0xF7 indicates an end of the system exclusive message.

System exclusive messages are also used for dumping data (for example, voice definitions) from the synthesizer. The data comes out of the synthesizer through the MIDI Out port, also in the form of system exclusive messages.

If you're attempting to program for MIDI in a device-independent manner, you should probably avoid using system exclusive messages. But they are valuable for defining new synthesizer voices.

THE MIDI MONITOR PROGRAM

If you have a MIDI keyboard or other MIDI controller, you can monitor all the MIDI messages it generates using the MIDIMON program included with the Multimedia Development Kit. This is a fairly simple program to use. You'll first want to run a MIDI cable from your keyboard's MIDI Out port to the MIDI In port of the MIDI board on your PC. Then just run the program. You'll probably want to use the menu option to filter out the Active Sensing messages. Then start banging on the keyboard and using the wheels and controllers. All the MIDI messages coming from the keyboard are displayed in the program's window.

This will give you a good idea of the MIDI messages that would have to be sent to a synthesizer to reproduce the sounds you're making with the keyboard.

Next time, I'll describe how I've set up my MIDI hardware on my PC and show you how to obtain the device capabilities of this hardware using the Multimedia Windows MIDI API calls. ■

by
Ray Duncan

Power Programming

Recognizing Handwritten Input in Pen Windows

In the last issue we discussed the basic steps you must take to make a conventional Windows application run acceptably in both the presence and absence of Pen Windows. First, you overhaul your application's user interface to eliminate keyboard input whenever possible in favor of menus, check boxes, radio buttons, and the like. Next, you check for the presence of Pen Windows at runtime by calling GetSystemMetrics (SM_PENWINDOWS), and then (if Pen Windows is detected) register the application as "pen-aware" by calling the Pen Windows API function RegisterPenApp().

The effect of the latter function call is that the application's EDIT controls are automatically converted into HEDIT (handwriting edit) controls, so that handwritten input is transparently translated to ASCII characters and shipped to the application as ordinary WM_CHAR messages. These changes yield an application that adapts to the environment but does not take full advantage of Pen Windows' capabilities.

You can further improve your application's "pen friendliness" by incorporating BEDIT (boxed edit) controls in your dialog boxes; these controls, which are unique to Pen Windows, facilitate character recognition by giving the user additional visual cues for character size and spacing.

As we saw in the last installment of this column, you can easily exploit BEDIT controls under Pen Windows and fall back on normal EDIT controls under plain-vanilla Windows merely by including alternative templates for each dialog, and then choosing the appropriate template at the application's runtime. Past this point, you move into the territory of programs that are pen-dependent rather than pen-aware.

In this column, we'll venture a bit further into the mysteries of Pen Windows as we take a look at dictionaries and their relationship to the recognizer module.

■ The Pen Windows recognizer module attempts to translate pen strokes into ASCII characters. It is hampered because its work is basically context-free. But by supplying its own dictionary module, an application can infuse context smartness into the recognition process.

RECOGNIZERS AND DICTIONARIES

Pen Windows is not really a distinct new species of Windows: It's just good ol' Windows plus an assortment of special device drivers and dynamic link libraries (DLLs). The key device drivers, of course, are the pen driver, which captures written input and turns it into a stream of (x,y) coordinates, and the display driver, which supports *inking* (turning on pixels to track the pen's motion). The most important "extra" DLLs are the main Pen Windows control module (PENWIN.DLL), a recognizer module, and the dictionary module(s). These modules and drivers and the pen-aware or pen-centric application communicate under the Recognition Context Manager's control via an API that is exported by PENWIN.DLL. Data is passed back and forth in several fairly complex structures, the most important of which is the Recognition Context (RC) data structure (shown in Figure 1) that is associated with each writing area.

Character recognition in Pen Windows is substantially different from the character recognition you might be familiar with from using scanners. Rather than simply trying to map patterns of pixels to character outlines like an OCR application, the Pen Windows recognizer analyzes patterns of pen strokes as well as the temporal relationship between the strokes. This makes it possible to "train" the recognizer for your own particular handwriting and drastically improves the recognizer's chances of differentiating otherwise-similar characters.

Consider, for instance, the capital letters *E* and *F*. Microsoft notes in the Pen Windows documentation that there are 384 distinct ways to write the capital *E* character when you take into account all the possible combinations of stroke order and stroke direction. Thus, the recognizer's chances of reliably distinguishing between *E* and *F*, even when they are written sloppily, are very good as long as you form each letter consistently.

Let's take a look at some written input to a pen-aware application at a very abstract level. The application must first define a writing area and pass the bounds of that area to the RC Manager. This might be done explicitly, as a direct application call to the Pen Windows API functions Recognize() or ProcessWriting(), or it might be done implicitly, when the application runs a dialog that contains HEDIT or BEDIT controls. The RC Manager dispatches the input request to the recognizer module, which then calls back through the RC Manager's GetPenHwData() en-

THE RECOGNITION CONTEXT DATA STRUCTURE

Structure Element	Significance
rc.hrec	Handle for recognizer, or RC_WCDEFAULT to use default recognizer module.
hc.hwnd	Handle for the window that will receive results from recognizer.
rc.wEventRef	Specifies the event that will trigger recognition.
rc.wRcPreferences	Controls certain user preferences (such as left-handed versus right-handed writing) and also contains a flag related to recognizer training.
rc.lRcOptions	Contains various flags for recognition options.
rc.lpfnYield	Address of a callback function used by the recognizer whenever it wants to yield control of the CPU; if NULL, recognizer calls Yield() directly.
rc.lpUser	Name of the current writer (can be used to select user-specific character recognition prototypes).
rc.lpLanguage	String indicating a language-specific character set.
rc.rglpdf	Array of 0 to 16 pointers to dictionary entry points.
rc.wTryDictionary	Specifies the cutoff point for the number of enumerations of a symbol graph, that is, the number of alternative translations that will be derived from a symbol graph by the RC Manager and passed to the dictionary module(s).
rc.clErrorLevel	Confidence level below which the recognizer should return the result "unknown" (set by the application).
rc.alc	Defines the alphanumeric character set(s) or subset(s) that is enabled. The recognizer will not return characters that are not in the specified set(s).
rc.alcPriority	Prioritizes character sets or subsets if more than one is enabled in rc.alc.
rc.rgbfAlc	A bitmap that defines which alphanumeric character codes are currently enabled for recognition.
rc.wResultMode	Specifies timing and granularity of result messages from the recognizer to the specified window.
rc.wTimeOut	Specifies a time-out threshold after which the recognizer will stop the recognition process.
rc.lPcm	Flags controlling the conditions that end recognition.
rc.RectBound	Defines the rectangle within which writing will occur. A pen-down event outside the rectangle will end recognition.
rc.rectExclude	Defines the rectangle within which any pen-down event will end recognition.
rc.guide	Controls the placement of guidelines within the writing area.
rc.wRcOrient	Specifies the orientation of the writing tablet.
rc.wRcDirect	Specifies the primary and secondary direction of writing. English is written left to right (primary) and top to bottom (secondary).
rc.nInkWidth	Specifies the width of the "ink" trail that tracks the stylus.
rc.rgbInk	Specifies the color of the "ink" trail that tracks the stylus.
rc.dwAppParam	Provided for private application use.
rc.dwRecognizer	Provided for private communication between an application and a custom recognizer module.
rc.dwDictParam	Provided for private communication between an application and a custom dictionary module.

Figure 1: The Recognition Context (RC) data structure is passed between the pen-aware or pen-centric application, the Recognition Context Manager, the recognizer module, and the dictionary module(s). Only a few of the fields are ever manipulated by an ordinary application.

try point to obtain ink data from the pen driver. With the ink data in hand, the recognizer must separate the ink stream into individual written symbols—called *glyphs*—and then attempt to assign each glyph to a character code or gesture.

When the recognizer is translating glyphs and finds an ambiguous character, it builds and returns a "symbol graph" that encapsulates all the alternative translations. For example, if you wrote the word *clean* but got the letters *c* and *l* a little too close together, the recognizer might not be able to tell whether you meant *cl* or *d* (particularly if you haven't used the Pen Windows trainer utility). In such a case, the recognizer would return a symbol graph that can be thought of as having the following meaning: { cl | d, e, a, n }. In effect, it would return the alternative strings "clean" and "dean."

If you also blurred the *n*, the recognizer might not be able to tell whether you meant an *n* or an *r*, and it would return the symbol graph { cl | d, e, a, n | r } to indicate the possible translations clean, clear, dean, and dear. The recognizer is responsible for assigning a weight or confidence factor to the alternative character translations, and in the worst case is allowed to opt out and return an "I don't know" result for an ink stream.

Now we can begin to see where the dictionary modules fit into the picture. When the Recognition Context Manager calls the recognizer module and gets back a complex symbol graph, it really has no internal justification for picking one possible translation over another. It can rely on the confidence factor that was returned by the recognizer, but this confidence factor is flawed because the recognizer's work is basically context-free; it doesn't take advantage of the application's knowledge of what the user is trying to enter. The application can infuse context smartness into the overall recognition process by establishing a dynamic link to a dictionary module, selecting a word list within the dictionary, and putting the entry point for the dictionary into the RC before it requests the written input. The Recognition Context Manager will then automatically pass the symbol graph from the recognizer module to the specified dictionary module, relying on the dictionary to look at its word list and pick out the most likely match from the various possibilities before the translated input is returned to the application.

Interestingly, although Microsoft in-

cludes a default recognizer (MARS.DLL) and a couple of default dictionaries (MAINDICT.DLL and USERDICT.DLL) in the Pen Windows package, these modules are completely replaceable. Example source code for a simple recognizer module and a custom dictionary is supplied in the Pen Windows SDK, and third-party developers are free to go their own directions and develop supplementary or substitute recognizers and dictionaries so long as they abide by the published interfaces. In fact, Pen Windows allows multiple recognizers and dictionaries to be active at any given time, and applications can load or unload specific recognizers and dictionaries while running.

USING DICTIONARIES IN PROGRAMS

We can use the Microsoft-supplied USERDICT.DLL as a relatively painless starting point for building dictionary usage into our own programs. USERDICT.DLL is self-contained and does not come with source code, but it is configurable to the extent that it gets its dictionary word lists from alphabetized lists in plain ASCII files on disks, and the names of these files can be passed to the dictionary via a well-documented interface.

Our demonstration program, DEMO4, is seen in action in Figure 2. As you can see, it's derived from the DEMO1, DEMO2, and DEMO3 programs we talked about in the last issue. DEMO4 has two menu entries, File-Exit and Edit-Enter. When the user selects Edit-Enter, he is presented with a dialog box with two BEDIT controls, one for entry of a city name, and one for entry of a state name. Our objective is to exploit USERDICT.DLL to improve recognition accuracy, by asking USERDICT to load a list of city names from the file CITIES.DIC and a similar list of state names from the file STATES.DIC, and then selecting the appropriate word list for each one of the BEDIT controls.

Figure 3 contains DEMO4.C, the main source code listing for the demonstration program. Figure 4 shows DEMO4.H, the C language header file that contains various manifest constants and function prototypes. Figure 5 contains DEMO4.DEF, the module definition file that is processed by the linker and controls the module name, segment characteristics, stack size, and so forth. Figure 6 holds DEMO4.RC, the resource script that is processed by the Resource Compiler to generate binary menu and dialog templates that are merged into the output from the Linker to form the final Windows executable file. The source code structure for DEMO4 is the same as for DEMO1 through DEMO3—even the six procedures' names in the program are identical—so we don't need to review the general workings of the program again. This frees us to concentrate on the dictionary-dependent aspects of the DEMO4 source code.

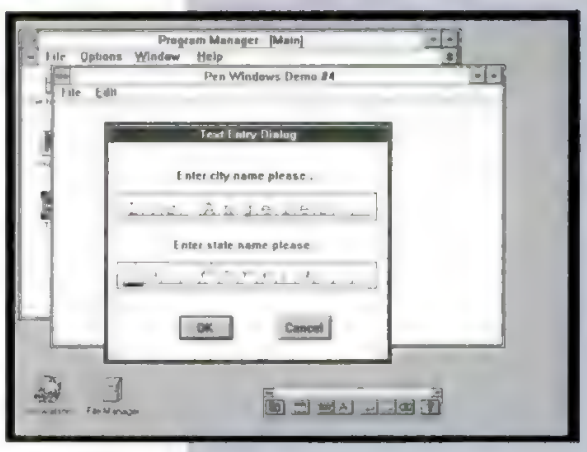

Figure 2: This simple interactive program prompts the user to enter a city and state name in a dialog box, then displays the input in the main window. The program uses the Microsoft user dictionary to assist the recognition process.

The only real difference between the WinMain() function of DEMO4 and the WinMain() of its predecessors is that DEMO4 makes no pretense of being able to run when Pen Windows is not present. The concept of dictionaries is unique to Pen Windows, and the only point of DEMO4 is to demonstrate dictionary usage. Consequently, the call to RegisterPenApp() is "hard-wired" into the program, so that the dynamic linkage is established at DEMO4's load time, rather than being implemented as runtime dynamic linking as it was in DEMO3.

If you attempt to run DEMO4 under ordinary Windows, you'll simply be presented with the semi-informative error message "Cannot find PENWIN.DLL, please insert in Drive A." The next procedure in DEMO4, InitApplication(), does not have any differences from its counterpart in DEMO3 at all.

Turning to the routine InitInstance(), we find more drastic changes have occurred in the evolution of the program. After the InitInstance() of DEMO3 has successfully created the frame window, it immediately displays the window and returns. But DEMO4's InitInstance() has other work to do. It first establishes a dynamic linkage to the entry point for DictionaryProc() in USERDICT.DLL with the Windows API functions LoadLibrary() and GetProcAddress(). It then calls DictionaryProc() directly, once for each of the two word list files (CITIES.DIC and STATES.DIC), and passes the command code DIRQ_OPEN. USERDICT.DLL then goes to the disk, loads the files, and returns a unique handle for each of the word lists.

To keep this example as simple as possible, I've built the exact pathnames for the word list files into the source code; in a real application, you would want to make this process more flexible, probably by having the program retrieve the file locations from WIN.INI or PENWIN.INI. Unfortunately, the source code is obscure enough due to C's notoriously cryptic notation for function pointers, even though I've eschewed most of the source code shorthand tricks and "optimizations" that delight hard-core C programmers.

The procedure MainWndProc(), which is the callback routine for DEMO4's frame window, again differs very little from the MainWndProc() of its DEMO3 ancestor. The only detectable differences are in a slightly different handling of the return code from DialogBox() and in the formatting of the output in the main window. The alterations made in DEMO4's DoCommand() procedure, similarly, are relatively minor.

Only when we come to EntryDlgProc(), which is the callback routine for the Edit-Enter dialog box, do we find two chunks of totally unfamiliar code. The first chunk runs when EntryDlgProc() is called with the WM_INITDIALOG message; in other words, when the dialog is first being created as a result of DoCommand()'s call to the Windows API function DialogBox(). It uses the Windows API function GetDlgItem() to retrieve the window handles

DEMO4.C — COMPLETE LISTING

```
// DEMO4.C  Pen-aware Windows application that demonstrates
// keyboard text input or handwritten input via a dialog, validating
// the input with user dictionary word lists.  The data is then
// displayed in the main window.
// Copyright (C) 1991 Ray Duncan

#define WIN31

#include "windows.h"
#include "penwin.h"
#include "demo4.h"

HANDLE hInst;                           // instance handle
HWND hWnd = 0;                          // main window handle
HWND hEditCity = 0;                     // City EDIT control handle
HWND hEditState = 0;                    // State EDIT control handle
HANDLE hUserDict = 0;                   // user dictionary handle
unsigned hCityList = 0;                 // handle for city wordlist
unsigned hStateList = 0;                // handle for state wordlist
FARPROC lpUserDict = NULL;              // user dictionary entry point
HANDLE hPenWin = 0;                     // Pen Windows module handle

#define INPUTSIZE 80                    // max length of input
#define OUTPUTSIZE 256                  // max length of output

char buf1[INPUTSIZE];                   // user's city input buffer
char buf2[INPUTSIZE];                   // user's state input buffer
char buf3[OUTPUTSIZE];                  // formatted output buffer

unsigned CancelFlag = TRUE;             // TRUE if input cancelled

//
// WinMain - entry point from Windows.  Registers window class,
// creates main window, processes messages until WM_QUIT received.
//
int PASCAL WinMain(HANDLE hInstance,
    HANDLE hPrevInstance, LPSTR lpCmdLine, int nCmdShow)
{
    MSG msg;

    hInst = hInstance;                  // save this instance handle

    if(!hPrevInstance)                  // if first instance,
        if(!InitApplication(hInstance))     // register window class
            return(FALSE);              // exit if couldn't register

    if(!InitInstance(hInstance, nCmdShow))  // create this instance's window
    {
        MessageBox(0, "Initialization failed!", "DEMO4", MB_OK|MB_ICONSTOP);
        return(FALSE);
    }
    RegisterPenApp(RPA_DEFAULT, TRUE);      // enable EDIT/SEDIT controls

    while(GetMessage(&msg, NULL, 0, 0))     // while message != WM_QUIT
    {
        TranslateMessage(&msg);             // translate virtual key codes
        DispatchMessage(&msg);              // dispatch message to window
    }
    return(msg.wParam);                     // return code = WM_QUIT value
}

//
//  InitApplication - registers window class for this application
//
BOOB InitApplication(HANDLE hInstance)
{
    WNDCLASS  wc;
                                        // set class parameters
    wc.style = NULL;                    // class style
    wc.lpfnWndProc = MainWndProc;       // class callback function
    wc.cbClsExtra = 0;                  // extra per-class data
    wc.cbWndExtra = 0;                  // extra per-window data
    wc.hInstance = hInstance;           // handle of class owner
    wc.hIcon = LoadIcon(NULL, IDI_APPLICATION);     // default icon
    wc.hCursor = LoadCursor(NULL, IDC_ARROW);       // default cursor
    wc.hbrBackground = GetStockObject(WHITE_BRUSH); // background color
    wc.lpszMenuName =  "DemoMenu";      // name of menu resource
    wc.lpszClassName = "DemoWinClass";  // name of window class

    return(RegisterClass(&wc));         // register class, return flag
}

//
// InitInstance - creates main window for this application instance
//
BOOL InitInstance(HANDLE hInstance, int nCmdShow)
{
    hWnd = CreateWindow(                // create frame window
        "DemoWinClass",                 // window class name
        "Pen Windows Demo #4",          // text for title bar
        WS_OVERLAPPEDWINDOW,            // window style
        CW_USEDEFAULT,                  // default horizontal position
        CW_USEDEFAULT,                  // default vertical position
        CW_USEDEFAULT,                  // default width
        CW_USEDEFAULT,                  // default height
        NULL,                           // no parent window
        NULL,                           // use class default menu
        hInstance,                      // window owner
        NULL                            // unused pointer
    );

    if(!hWnd) return(FALSE);            // error, can't create window

                                        // link to user dictionary
    if((hUserDict = LoadLibrary("userdict.dll")) <= 32)
        return(FALSE);                  // give up if dynlink failed
    if((lpUserDict = GetProcAddress(hUserDict, "DictionaryProc")) == NULL)
        return(FALSE);                  // give up if dynlink failed

                                        // open the user word lists
    (lpUserDict)(DIRQ_OPEN, (LPSTR) "c:\\source\\cities.dic",
                (LPWORD) &hCityList, sizeof(hCityList), 0L, 0L);
    (lpUserDict)(DIRQ_OPEN, (LPSTR) "c:\\source\\states.dic",
                (LPWORD) &hStateList, sizeof(hStateList), 0L, 0L);
    if((!hCityList) || !(hStateList))   // give up if word list
        return(FALSE);                  // files were not found

    ShowWindow(hWnd, nCmdShow);         // make window visible
    UpdateWindow(hWnd);                 // force WM_PAINT message
    return(TRUE);                       // return success flag
}

//
// MainWndProc - callback function for main application window
//
long FAR PASCAL MainWndProc(HWND hWnd, WORD wMsg, WORD wParam, LONG lParam)
{
    HDC hdc;                            // device context handle
    PAINTSTRUCT ps;                     // painting info structure
    RECT rect;                          // receives client rectangle

    switch (wMsg)
    {
        case WM_COMMAND:                // menu command received,
            DoCommand(hWnd, wParam);
            break;

        case WM_PAINT:                  // window needs repainting
            hdc = BeginPaint(hWnd, &ps);    // get device context
            GetClientRect(hWnd, &rect);     // get client rectangle
            if(!CancelFlag)             // format user's input
                wsprintf(buf3, "The city is %s, the state is %s.",
                        (LPSTR) buf1, (LPSTR) buf2);
            else strcpy(buf3, "No data entered!");
            DrawText(hdc, buf3, -1, &rect,  // display formatted text
                DT_SINGLELINE | DT_CENTER | DT_VCENTER);
            EndPaint(hWnd, &ps);            // release device context
            break;

        case WM_SIZE:                   // window resized
            InvalidateRect(hWnd, NULL, TRUE);   // repaint everything
            UpdateWindow(hWnd);             // force WM_PAINT message
            break;

        case WM_DESTROY:                // window being destroyed
            PostQuitMessage(0);
            break;

        default:                        // let Windows handle it
            return(DefWindowProc(hWnd, wMsg, wParam, lParam));
    }

    return(0);
}

//
// DoCommand - handles menu command messages.
//
void DoCommand(HWND hWnd, WORD wParam)
{
    FARPROC lpProc;                     // far pointer to callback

    switch(wParam)                      // decode it
        case IDM_EXIT:                  // user picked File-Quit
            SendMessage (hWnd, WM_CLOSE, 0, 0L);
            break;

        case IDM_ENTER:                 // user picked Edit-Enter
            lpProc = MakeProcInstance(EntryDlgProc, hInst);
            CancelFlag = DialogBox(hInst, "TextEntryBox", hWnd, lpProc);
            InvalidateRect(hWnd, NULL, TRUE);   // repaint everything
            UpdateWindow(hWnd);             // force WM_PAINT message
            FreeProcInstance(lpProc);
            break;

        default:                        // unknown command, ignore it
            break;
    }
}

//
// EntryDlgProc - callback function for "Text Entry..." dialog
//
BOOL FAR PASCAL EntryDlgProc(HWND hDlg, WORD wMsg, WORD wParam, LONG lParam)
{
    RC rc;

    switch (wMsg)
    {
        case WM_INITDIALOG:             // dialog box initialization

                                        // get SEDIT window handles
            hEditCity = GetDlgItem(hDlg, IDD_EDITCITY);
            hEditState = GetDlgItem(hDlg, IDD_EDITSTATE);

                                        // configure RC for City SEDIT
            SendMessage(hEditCity, WM_SEDITCTL, SE_GETRC, (LONG) ((LPRC) &rc));
            rc.lRcOptions = rc.lRcOptions | RCO_NOSPACEBREAK | RCO_SUGGEST;
            rc.rglpdf[0] = lpUserDict;
            rc.rglpdf[1] = NULL;
            rc.alc = ALC_ALPHA;
            SendMessage(hEditCity, WM_SEDITCTL, SE_SETRC, (LONG) ((LPRC) &rc));

                                        // configure RC for State SEDIT
            SendMessage(hEditState, WM_SEDITCTL, SE_GETRC, (LONG) ((LPRC)
&rc));
            rc.lRcOptions = rc.lRcOptions | RCO_NOSPACEBREAK | RCO_SUGGEST;
            rc.rglpdf[0] = lpUserDict;
            rc.rglpdf[1] = NULL;
            rc.alc = ALC_ALPHA;
            SendMessage(hEditState, WM_SEDITCTL, SE_SETRC, (LONG) ((LPRC)
&rc));

            return (TRUE);              // signal message processed

        case WM_COMMAND:                // command received
            if(HIWORD(lParam) == EN_SETFOCUS)
            {                           // SEDIT receiving focus,
                if(wParam == IDD_EDITCITY)  // select proper word list
                    (lpUserDict)(DIRQ_SETWORDLISTS, (LPWORD) &hCityList,
                                0L, 1, 0L, 0L);
                else if(wParam == IDD_EDITSTATE)
                    (lpUserDict)(DIRQ_SETWORDLISTS, (LPWORD) &hStateList,

                                0L, 1, 0L, 0L);
            }
            else if(wParam == IDOK)         // OK button clicked?
            {                               // yes, retrieve text
                GetDlgItemText(hDlg, IDD_EDITCITY,  buf1, INPUTSIZE-1);
                GetDlgItemText(hDlg, IDD_EDITSTATE, buf2, INPUTSIZE-1);
                EndDialog(hDlg, FALSE);     // signal text accepted
            }
            else if(wParam == IDD_CANCEL)   // Cancel button clicked?
            {
                EndDialog(hDlg, TRUE);      // signal input was cancelled
            }
    }
    return(FALSE);                          // signal message not processed
}
```

Figure 3: The source code for DEMO4, a pen-aware program that uses the Microsoft user dictionary to assist the recognition process.

DEMO4.H — COMPLETE LISTING

```
#define IDM_EXIT  100
#define IDM_ENTER 101

#define IDD_CANCEL      200
#define IDD_EDITCITY    201
#define IDD_EDITSTATE   202

int PASCAL WinMain(HANDLE, HANDLE, LPSTR, int);
BOOL InitApplication(HANDLE);
BOOL InitInstance(HANDLE, int);
long FAR PASCAL MainWndProc(HWND, unsigned, WORD, LONG);
BOOL FAR PASCAL EntryDlgProc(HWND, unsigned, WORD, LONG);
void DoCommand(HWND, WORD);
```

Figure 4: This is the C language header file for DEMO4.C.

DEMO4.DEF — COMPLETE LISTING

```
;
; DEMO4.DEF - Module definition file for DEMO4.C
;
NAME            DEMO4
DESCRIPTION     'Demo Program #4'
EXETYPE         WINDOWS
STUB            'WINSTUB.EXE'
CODE            PRELOAD MOVEABLE DISCARDABLE
DATA            PRELOAD MOVEABLE MULTIPLE
HEAPSIZE        1024
STACKSIZE       8192
EXPORTS
  MainWndProc
  EntryDlgProc
```

Figure 5: This module definition file defines the program's module name, code and data segment characteristics, stack and heap size, and other information used by the linker.

DEMO4.RC — COMPLETE LISTING

```
#include "windows.h"
#include "demo4.h"

DemoMenu MENU
BEGIN
  POPUP "&File"
    BEGIN
      MENUITEM "E&xit",       IDM_EXIT
    END
  POPUP "&Edit"
    BEGIN
      MENUITEM "&Enter text...", IDM_ENTER
    END
END

TextEntryBox DIALOG 36, 24, 161, 125
CAPTION "Text Entry Dialog"
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION
BEGIN
  CTEXT "Enter city name please...", -1, 5, 15, 150, 8, WS_CHILD | WS_VISIBLE | WS_GROUP
  CONTROL " ", IDD_EDITCITY, "bedit", ES_LEFT | WS_CHILD | WS_VISIBLE | WS_BORDER | WS_TABSTOP, 5, 29, 150, 16
  CTEXT "Enter state name please...", -1, 5, 55, 150, 8, WS_CHILD | WS_VISIBLE | WS_GROUP
  CONTROL " ", IDD_EDITSTATE, "bedit", ES_LEFT | WS_CHILD | WS_VISIBLE | WS_BORDER | WS_TABSTOP, 5, 69, 150, 16
  DEFPUSHBUTTON "OK", IDOK, 41, 100, 31, 14, WS_CHILD | WS_VISIBLE | WS_TABSTOP
  PUSHBUTTON "Cancel", IDD_CANCEL, 90, 100, 31, 14, WS_CHILD | WS_VISIBLE | WS_TABSTOP
END
```

Figure 6: The resource script for DEMO4.C contains the definitions of the program's menu and dialog.

of the two BEDIT controls, and then puts the address of the DictionaryProc() entry point in USERDICT.DLL into the RC structures associated with each of those controls.

The other chunk of code runs when EntryDlgProc() is called with the WM_COMMAND message. It checks the "lParam" element of the message for the code EN_SETFOCUS to determine whether the message was triggered by one of the BEDIT controls receiving the focus. If so, it calls USERDICT.DLL to select the cities word list or the states word list as appropriate, using the word list handles that were previously obtained and saved by InitInstance().

Having gone to all this trouble, what do we get for it? Sadly enough, not very much. Recruiting USERDICT.DLL into the recognition process has virtually no discernible effect on recognition accuracy. At first I thought this must be due to my misunderstanding of the USERDICT.DLL documentation or flaws in my source code (and I guess it still could be), but I went back and closely examined the EXPENSE sample program in the Pen Windows SDK—which works on very similar principles—and EXPENSE doesn't seem to benefit from its use of USERDICT.DLL either. Of course, Pen Windows is still in beta test as this is written, and the behavior of USERDICT.DLL may change drastically before the retail release.

You can find more information about USERDICT.DLL and MAINDICT.DLL buried in the documentation for DictionaryProc() in the API reference of the Pen Windows programmer's manual. In the meantime, we have all the groundwork in place to implement and test our own custom dictionary module in the next installment of Power Programming.

THE IN-BOX

Please send your questions, comments, and suggestions to me at any of the following electronic mail addresses:
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CIRCLE 183 ON READER SERVICE CARD

by
Sal Ricciardi

Databases

DICTIONARY OF TABLES

When developing *Paradox* applications for my clients, I find it useful to be able to refer to an up-to-date representation of my entire database schema. *Paradox*, however, only lets you retrieve the structure of one table at a time.

To solve this problem, I wrote the script shown in Figure 1. DD.SC creates a dictionary containing all of the table structure information for the tables in the current directory. The master table, DD.DB, includes two report definitions for presenting the schema information. The first reports the data ordered by table (report 1). The second reports the data ordered by field name (report 2).

Henry L. Bremers
Boulder, Colorado

This can be a handy tool when you're building *Paradox* applications in PAL. It creates a table containing all of the field structure information for tables in the current directory. Since many people store all of the tables for an application in a separate subdirectory on their hard disk, DD can, when run in that subdirectory, quickly produce a snapshot of the entire application's field names and types.

You'll need to copy the DD family of files (DD.DB, DD.R1, and DD.R2) to the subdirectory where your application resides before running the script. You can use the *Paradox* menu's {Tools}{Copy}{Table} to get the whole family at once, or DOS to copy each file individually. You may want to do this whenever you create a subdirectory to start a project.

The DD table defines two reports. The first creates a report ordered by table. This lets you look at the field structures for each of an application's tables, all in one report. The second creates a report ordered by field name. This shows you at a glance whether or not you've already used a field name somewhere in one of your application's tables, and finds out how many tables use the same field.

■ DICTIONARY OF TABLES: A script that lets you see all of the table structure information for your *Paradox* applications.

Samples of the two defined reports that are included are shown in Figure 2. The script works by first creating a temporary table containing one row for each table in the current directory. The temporary table, which *Paradox* calls List, is created using the *Paradox* script command

```
MENU {Tools} {Info}
  {Inventory} {Tables} {}
```

DD.SC — COMPLETE LISTING

```
;-----------------------------------------------------------------
; DD.SC                                                Paradox 3.5
; Create a table structure dictionary for the current directory.
;-----------------------------------------------------------------
IF NOT ISFILE("DD.DB")                  ; If file not found, error
   THEN
   QUIT "File DD.DB not found."
ELSE
   EMPTY "DD"                          ; Empty the dictionary table
   MESSAGE "DD: Creating table structure dictionary.."
ENDIF
CANVAS OFF
SETDIR DIRECTORY()                      ; Get rid of temporary tables
                                        ;  and clear workspace
MENU {Tools} {Info}
{Inventory} {Tables} {}                 ; Get a list of tables in current
RENAME "List" "Tables"                  ;  directory and rename it
QUERY
 Tables | Name          |               ; Removes List and Dd from the
 delete | List OR Dd    |               ;   table of table names
ENDQUERY
DO_IT!                                  ; Do the query
MOVETO 1                                ; Move to first image on workspace
CLEARIMAGE                              ; Remove the query image
numrec = NRECORDS("Tables")             ; Get number of tables
FOR count FROM 1 TO numrec              ; Loop through each entry
   MOVETO "Tables"                      ; Move to the "Tables" Image
   MOVETO RECORD count                  ; Move to the next record
   tabname = [name]                     ; Assign table name to tabname
   MENU {Tools} {Info} {Structure}      ; Get the structure of the table
   SELECT tabname                       ;   in table STRUCT
   QUERY                                ; Insert the table name, field
                                        ;   and field type into DD table
       Dd     | Table Name | Field Name | Field Type |
       insert | ~tabname   | _fn        | _ft        |

       Struct | Field Name | Field Type |
              | _fn        | _ft        |
   ENDQUERY
   DO_IT!                               ; Do the query
ENDFOR
DELETE "Tables"                         ; Remove the table of tables
SETDIR DIRECTORY()                      ; Get rid of temporary tables
                                        ;  and clear workspace
CANVAS ON
MESSAGE "DD: Finished..."
VIEW "DD"                               ; View the Dictionary table
```

Figure 1: This PAL script creates a table containing all the fields and their types for all of the tables in the current directory.

DD REPORT SAMPLES

```
10/02/91    Table Structure Dictionary     Page   1
                  Table Report

Field name                  Field Type
========================    ==========
Carriers
-------------------------------------
Carrier Service             A20
Charge                      $

Cust
-------------------------------------
Address                     A25
City                        A15
Customer No.                S*


10/02/91    Table Structure Dictionary    Page   1
                  Field Report

Field Name                  Field Type  Table Name
-------------------------   ----------  ----------
Address                     A25         Cust
Amount                      $           Orders
Carrier Service             A20         Carriers
Charge                      $           Carriers
City                        A15         Cust
Credit Card No.             A20         Invoice
Customer No.                S*          Cust
Customer No.                S           Invoice
```

Figure 2: Examples of the two reports defined for the DD table.

Next, the script searches for and deletes the entries for the List and Dd tables in the list of tables, since they aren't part of your application. In this manner, DD suppresses the listing of its own structure. Then, starting with the first row, it takes each row in turn, extracts the table name, and inserts the structure for that table into DD.DB.

You'll notice the following line twice in the listing:

```
SETDIR DIRECTORY()
```

This command sets the current directory to the current directory, effectively not changing the directory at all. But in so doing, it clears the *Paradox* workspace and deletes *Paradox*'s temporary tables—a clever shortcut to let you start with a clean slate.

The DD script and associated files can be found in DD.ZIP on PC MagNet.

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edited by
Sharon Terdeman

Languages

REBOOT ROUTINE

Sometimes I need to reboot a PC from within a BASIC program, and I've discovered a simple but effective way to do this. The short QuickBASIC subprogram shown in Figure 1 will restart a PC, using either a warm or cold boot specified as a passed parameter. To force a cold boot (which includes the complete memory test) use a value of zero for the parameter (Warm%). If Warm% receives any value other than zero, REBOOT will perform a warm boot, which is faster but less secure.

REBOOT works by calling a routine in the PC's BIOS that is always located at address FFFF:0000. The first thing this routine does is examine address 0000:0472 to see whether a warm boot has been requested. If it finds the value &H1234, it means some program put it there to request a warm boot.

To use this program you'll need to start QuickBASIC with the /l option, which tells it to load the QB.QLB Quick Library. The Absolute command is an external assembly language subroutine contained in this library. In order to create a final standalone .EXE program you must then link with the QB.LIB library file.

Vikram Pandya
Rajkot, India

PC MAGAZINE There are occasions when it's useful to be able to reboot the PC from within a program. One case might be when a user enters an invalid password for the third time; waiting for the PC to start over again each time will discourage most attempts to guess a password. Another situation is when you're working with sensitive data. Even though your program has finished, the data is still sitting there in memory. Anyone with a memory-browsing utility could easily view that data. But if the computer is rebooted, the data will be overwritten during the initial memory test.

Note that if you are using Microsoft's BASIC 7.0 compiler, the Absolute routine is located in the QBX.LIB and QBX.QLB files.—*Ethan Winer*

- **REBOOT ROUTINE:** Here's how to restart a PC from within a QuickBASIC program.
- **OBTAINING RANDOM NUMBERS:** Further investigation of the Random function in Turbo Pascal.
- **CONTROLLING PRINTED LISTINGS:** How to insert a form-feed character into your QuickBASIC programs.

REBOOT.BAS — COMPLETE LISTING

```
DECLARE SUB ReBoot (Warm%)

CALL ReBoot(1) 'Save this program before running it!

SUB ReBoot (Warm%) STATIC
  IF Warm% THEN          'if they want a warm boot
    DEF SEG = 0          'assign the value 1234 Hex
    POKE &H473, &H12     'to address 0000:0472 Hex
    POKE &H472, &H34
  END IF
  DEF SEG = &HFFFF       'either way call the BIOS
  CALL Absolute(0)       'routine at FFFF:0000 Hex
END SUB
```

Figure 1: This subprogram lets you restart a PC using either a warm or cold boot.

OBTAINING RANDOM NUMBERS

I immensely enjoyed your recent discussion of card-shuffling algorithms (Languages, August 1991). You correctly pointed out that the submitted algorithm, even when allowed to swap cards with themselves, does not yield each possible arrangement of cards with equal likelihood since it must take one of *nn* paths to the final arrangement, and *nn* is not evenly divisible by *n!*, the number of possible arrangements. But alas! Not even your corrected program results in the same chance for all possible arrangements. In fact, *most* of the arrangements cannot occur at all. Why not? Because the program must rely on an imperfect random-number generator (though this isn't the algorithm's fault, of course).

At the beginning of the program, this random-number generator is seeded by the Randomize procedure. Although there are no rules dictating the internal operation of Randomize, I suspect that most PC compilers obtain the seed in some way from the current BIOS clock tick count, a more-or-less arbitrary number from 0 to 1,573,040. Thus there can be at most 1,573,040 distinct paths to the final arrangement of cards. On the other hand, there are a whopping 52! (about 8 x 1,067) different ways to arrange the deck. This means that for every different arrangement of cards that can result from the shuffling program, there are about 5 x 1,061 arrangements that cannot. (The entire solar system consists of "only" about 1,057 individual atoms!)

Edward Morris
Delavan, Illinois

PC MAGAZINE Mr. Morris is quite correct: Figure 2 shows a Turbo Debugger disassembly of the Randomize procedure. Randomize calls DOS function 2Ch (the time-of-day function) and puts the 32-bit result into the variable RandSeed. The value returned by the time-of-day function is calculated from the current number of timer ticks, and after 1,573,040

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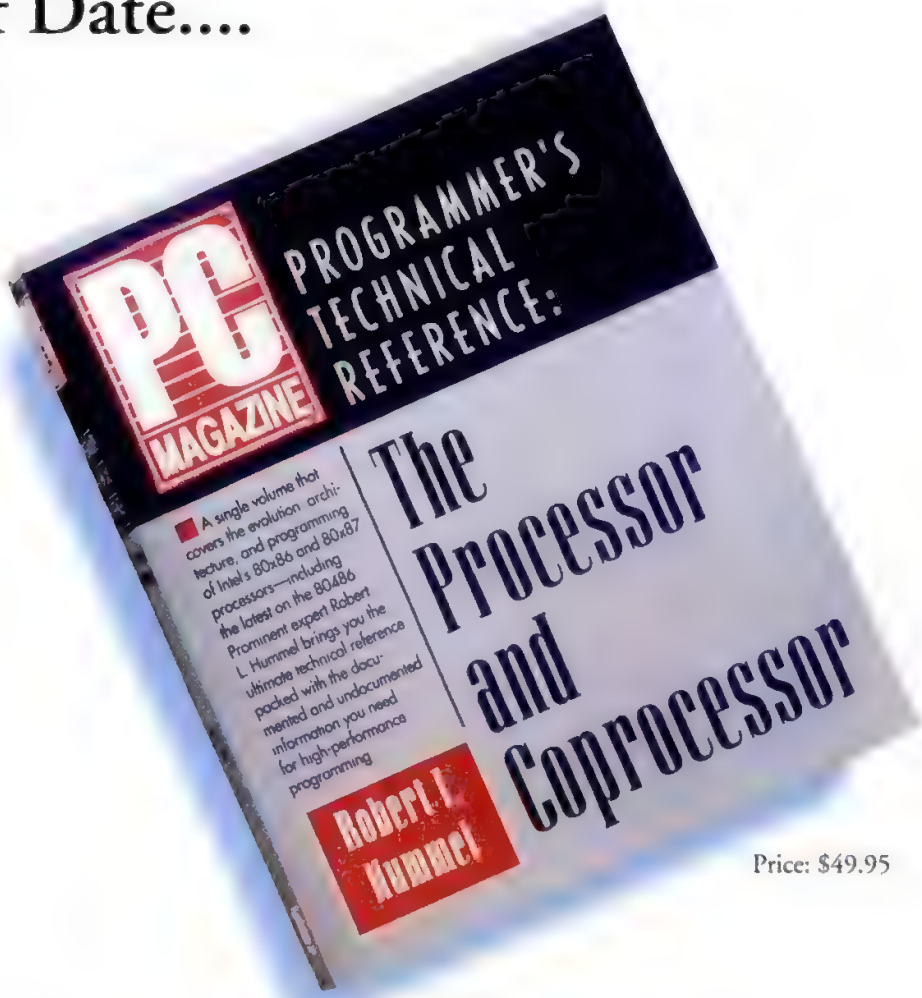

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DISASSEMBLY OF RANDOMIZE PROCEDURE

```
Turbo Debugger Log
Stopped at RAND.4
CPU 80486
  cs:059A B42C        mov  ah,2C
  cs:059C CD21        int  21
  cs:059E 890E3E00    mov  [SYSTEM.RANDSEED],cx
  cs:05A2 89164000    mov  [0040],dx
  cs:05A6 CB          retf
```

Figure 2: This disassembly of the Turbo Pascal Randomize procedure shows that it seeds the random-number generator based on the value returned by the DOS time-of-day function.

timer ticks (one day) the tick count is reset to zero. Hence there are only 1,573,040 possible distinct values returned by that function. This method isn't specific to Turbo Pascal; most languages that provide a random function seed it from the timer.

Each time you call Random, it returns a random number based on the current seed and then calculates a new seed value. The random-number generator called by the Random function is carefully designed so that it passes through every other possible 32-bit value before coming back to the original seed value. However, if you start the random-number generator with a particular seed, repeated calls to the Random function will always produce the exact same pseudo-random series. Consequently there can only be as many different final arrangements of the shuffled cards as there are different starting seeds.

In most programs, this limitation won't be significant, but as a programmer, you should be aware it exists. If in a particular situation it's necessary to provide a wider range of random-number seeds, you'll have to use a method other than Randomize. One possibility is to purchase a book of random numbers and use a new set from the book each time, eliminating numbers as you use them. Another is to require the user to enter a number (insist on *several* digits!) and XOR that number with the seed produced by Randomize. Still, it's important to remember that any computer-based algorithm is only going to produce pseudo-random numbers. —*Neil J. Rubenking*

CONTROLLING PRINTED LISTINGS

I've found it extremely frustrating that there is no way to control how a QuickBASIC program listing is formatted when you send it to a printer. I like each subprogram and function to begin on a new page, however, there's no way to insert a CHR$(12) form-feed character directly into the listing. Many word processors allow you to enter this character by pressing and holding the Alt key, and then typing the number 12 on the numeric keypad. But in the QuickBASIC editor, pressing the Alt key always brings up the menu.

The solution I devised was to create a short program called FF.BAS using EDLIN, which does allow a CHR$(12) to be entered using the Alt key. The program contains only an apostrophe remark symbol and the form-feed character. I merge this file at the beginning of every subroutine in my programs. Now when I select the print option from QuickBASIC's File menu, each routine listed starts on a new page.

Bruce Yellin
Berkeley Heights, New Jersey

Although you certainly can use EDLIN to create a file with an embedded CHR$(12) and then merge that into a BASIC program, there's a much better way to force a form-feed. The QuickBASIC editor lets you enter control characters directly into a source listing by first pressing the Ctrl-P key. Nearly any character may then be entered, including those that require the Alt key.—*Ethan Winer*

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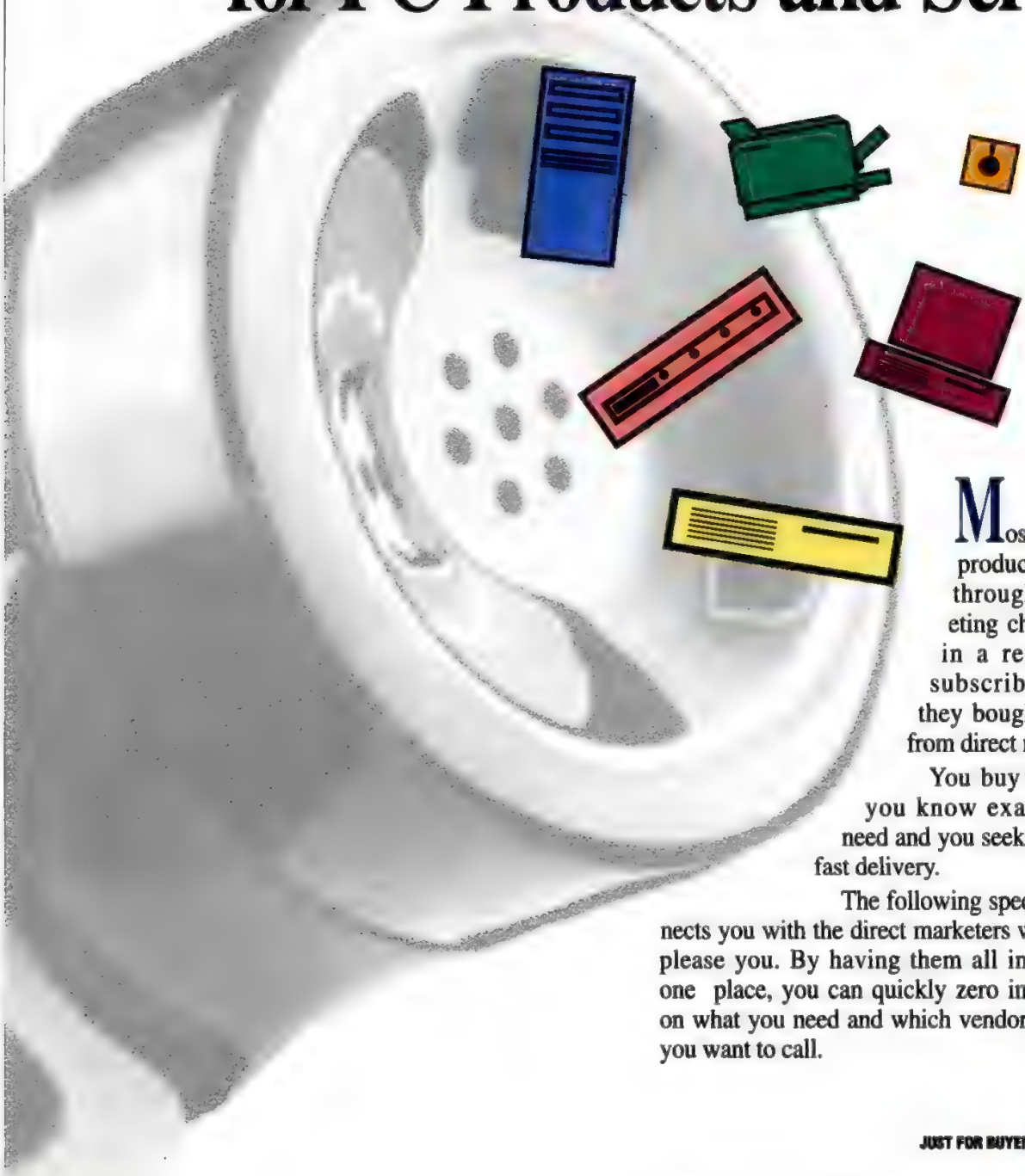

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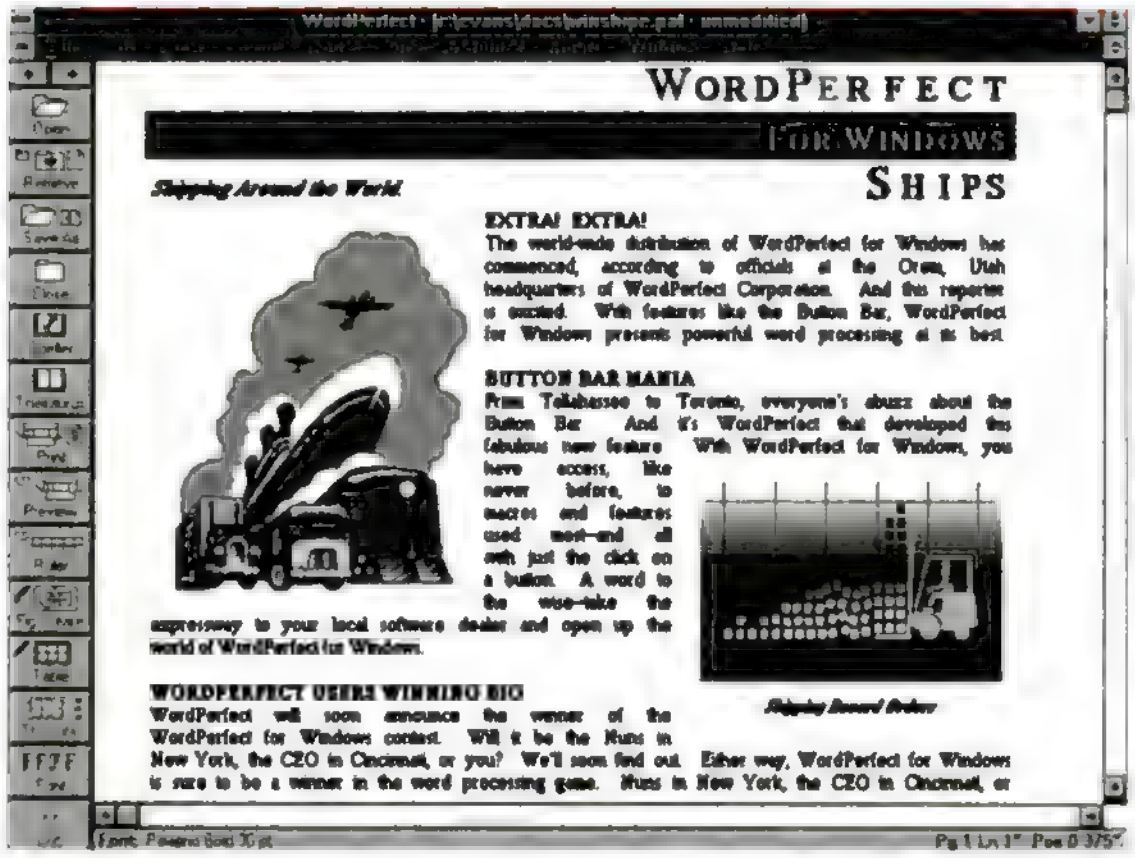

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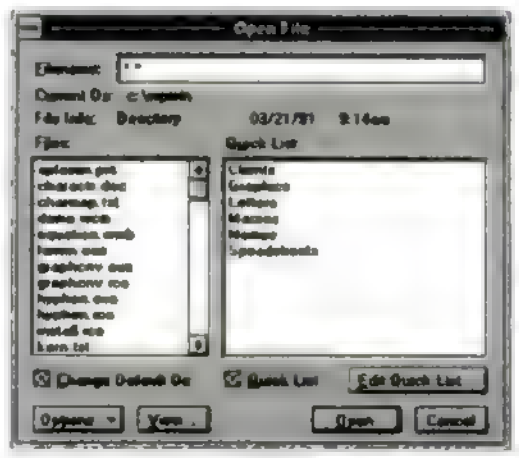

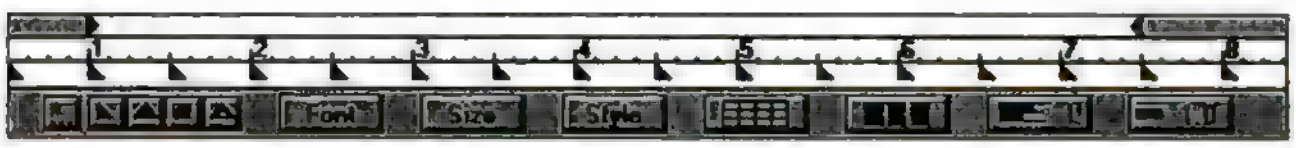

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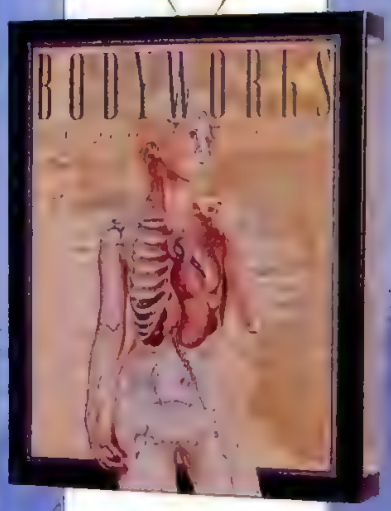

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The human body is the ultimate machine, and now you can explore its systems, structures and functions in fascinating detail. Bodyworks lets you focus on skeletal, muscular, nervous, digestive, cardiovascular, reproductive and other systems.
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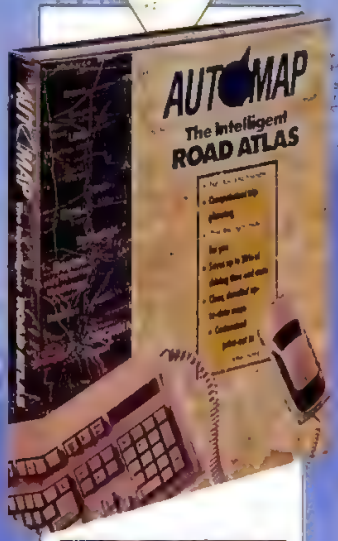

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Clear, detailed maps that can get you anywhere in the United States. Just tell Automap where you are going, where you're starting from, what areas you'd like to visit (or avoid) and how you drive. View your entire journey in full color on the screen, or print out for easy reference. Its fast, fun and informative, plus it pays for itself in saved fuel and time.

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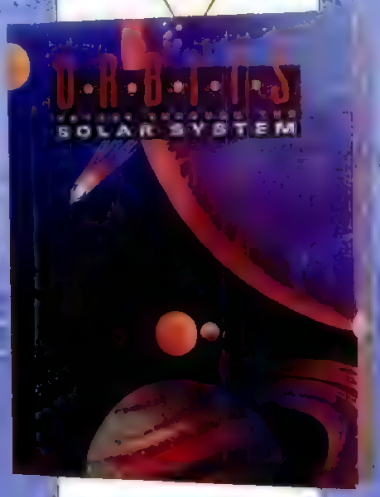

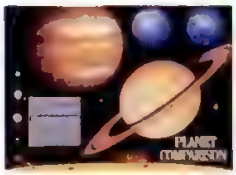

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An interactive space simulator and atlas of the solar system. Through colorful animation and 3-D graphics, you'll witness lunar and solar eclipses, follow the clockwork motion of the solar system and travel into the heart of the sun. Study actual satellite photographs and compare the planets. This exciting and educational trip into space is as near as your PC.

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CIRCLE 027 ON READER SERVICE CARD

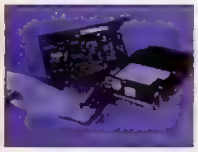
FASTMICRO Hardware 1-800-441-FAST

DISK DRIVES

CD-ROM
- Hitachi Ext 680mb Kit ... 499
- Sony Int 680mb Kit ... 349
- Book of Mammals / Enciopedia ... 49/69
- MS Bookshelf, Stat. Pack, World Atlas & Consultant CDs ... 99

Colorado
- DJ-10 40-120mb Int. Tape ... 199
- DJ-20 80-240mb Int Tape ... 259
- External Kit w/AB11 ... 99

Toshiba 100mb IDE Kit $369



Upgrade your 286 or 386 to IDE technology and Toshiba quality at a FastMicro price. This kit comes with a fast 20ms 105mb drive and built in 1:1 controller, 16 bit IDE card with dual floppy controller & cables, 5.25" brackets & rails.

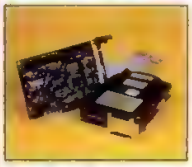
Conner (see FastData IDE controllers)
- CP3044 40mb IDE 28ms ... 199
- CP3104 100mb IDE 25ms ... 349
- CP3208 200mb IDE 25ms ... 599

DTC
- 6280 ESDI 16bit HD/FD Cont. ... 119
- 6280-15T 15mbit/sec transfer rate ... 169

Micropolis (see DTC Controllers)
- MC1664 345mb HH ESDI 14ms ... 999
- MC1568 668mb FH ESDI 14ms ... 1399
- MC1518 1.3gb FH ESDI 14ms ... 1999

NEC Ext CD Gallery w/CDR36 ... 559

Plus Development
- HardCard IIXL 50mb 9 ms 16bit ... 299



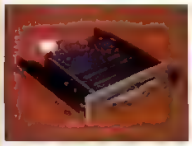
Seagate 89mb AT Kit $319

IDE performance, big 89 megabyte capacity, 19ms access time and 5 mbps transfer rate make this a great buy. Controller, cables and rails are included to make installation fast and easy.

- HardCard IIXL 105mb 9 ms 16bit ... 469

Seagate
- 30MB XT Kit ST238 w/ cont. ... 249
- 40MB AT ST251-1 MFM Drive ... 229
- 40MB AT ST157A 28ms IDE Drive ... 179
- 89MB ST3096A 19ms IDE Drive ... 299
- 125MB ST3144A 19ms IDE Drive ... 359
- 210MB ST1239A 15ms IDE Drive ... 599
- 330MB ST2383E 16ms ESDI Drive ... 1199

Teac
- 1.2MB 5.25" Floppy ... 59
- 1.44MB 3.5" Floppy ... 59



Toshiba 1.44mb Floppy $59

Complete with mounting brackets and installation instructions, this Toshiba works in all true 286 & 386 compatibles. Will also read/write/format 720K 3.5" disks. Rails add $5.

Toshiba
- 360K 5.25" Floppy (Black) ... 59
- 1.2MB 5.25" Floppy ... 59
- 1.44MB 3.5" Floppy ... 59

Western Digital
- WD93044 40mb IDE 28ms ... 199
- WDAC280 80mb IDE 20ms ... 299
- WDAP4200 200mb IDE 20ms ... 599

MODEMS & FAX

ATI
- 2400 ETC V 42 Int / Ext ... 129/155
- 9600/E External MNP V 42bis ... 369

Everex 2400B Int MNP Modem ... 65

ATI 9600ETC•E $369

ATI delivers speed and accuracy with the 9600 Etc•E. It includes V 42 LAP-M, and MNP error correction combined with MNP/5 and V 42 bis data compression to provide total high speed throughput. It features automatic line speed correction, synchronous/asynchronous communication and automatic feature negotiation with connecting with other modems.

Hayes
- JT FAX 4800B Internal ... 139
- Personal Modem 2400 w/Prodigy ... 119
- Pocket Edition 2400 Modem ... 119

Intel
- Classic 2400 Modem Int./ Ext. ... 139/169
- Satisfaxtion Classic - Intl 9600 ... 369

OmniLink Laser $379

Don't settle for curled up thermal paper or tie up your PC to receive faxes, get OmniLink Laser. It connects to your phone line and HP compatible laser and receives and prints your faxes. You can still print anytime you want and OmniLink will store up to 30 faxes while your printing. Plus, its a standard 2400/9600 modem/sendfax and software is only $89.

Practical Peripherals
- 2400B Int Modem Std/MNP ... 125/159
- PM9600SA Ext. V 32/V 42bis ... 449

USRobotics
- 2400 Sportster Int / Ext ... 119/135
- 2400 Sportster MNP Int / Ext ... 159/189
- 9600 Sportster Int / Ext ... 399/449
- Courier HST 14,400 Int / Ext ... 539/559
- Courier HST 14,400 Dual Std Ext. ... 799

ZOOM
- HC2400 Internal ... 69
- 2400 V 42bis External Modem ... 125
- 9624 Send/Receive Int Fax Modem ... 105

MICE & INPUT

Key Tronic 101 Keyboard ... 59
- Professional Mouse ... 59

Logitech
- Mouseman Serial righthand ... 59
- Mouseman Serial with Windows ... 109
- Mouseman Bus righthand ... 65
- Mouseman Cordless ... 85
- ScanMan 32 ... 149
- ScanMan 32 with Catchword ... 199
- ScanMan 256 for Windows ... 259
- Trackman Serial ... 65

Microsoft Mouse $83

Ergonomic design and 400 DPI accuracy make this the world's most popular mouse. Microsoft design and mouse utilities assure compatibility with the programs you use most.

Microsoft
- Serial or Bus Mouse only ... 83
- Serial or Bus with paint ... 95
- Serial with Windows ... 147

Z-Nix Super Mouse II w/Windows ... 79

International orders welcome

NETWORKING

Artisoft/Lantastic
- Lantastic Two Station Starter Kit 2 Mbps ... 349
- Ethernet ... 469
- Ethernet Additional Stations ... 209

Eagle NE2000 2 Station NW Lite Kit ... 459

FastData NE2000 16 Bit 10-BaseT ... 109

Novell
- Netware Lite ... 65
- Netware Lite with DR DOS 6.0 ... 75

BOARDS & CHIPS

Adlib Gold 1000/2000 ... 185/285

ATI Stereo F/X ... 129

Brown Wagh
- Sound Blaster ... 105
- Sound Blaster Pro (stereo & MIDI) ... 179

Cyrix 387-DX25/33 ... 179/189
- 387-SX16/20/25 ... 109/119/129

Everex
- RAM3000 16 bit - w/ 0K (max 3mb) ... 75
- RAM3000 16 bit - w/ 1mb ... 125
- RAM8000 16 bit - w/ 0K (max 8 mb) ... 169
- RAM8000 16 bit - w/ 2mb ... 269

Intel 287XL ... 75
- 387-DX25 or 33 ... 209
- 387-SX16 / 20 ... 119/129

Memory - 1mb SIMMS 80ns ... $49

Memory - 1mb chips 80ns set of 9 ... $59

FASTDATA PRODUCTS

FastData 16 Bit VGA $69 $89

The FastData 16 bit VGA card features 256K or 512K of video memory, does CGA, EGA & VGA up to 1024x768 (512K vers.) and comes with drivers for popular software including Windows. It comes with a 30 day money back guarantee.

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- FastData CGA Card ... 35
- FastData MGP Card ... 29

FastData Monitors

Your best value, guaranteed! We have full line manufactured for us by manufacturers like Hyundai and Matsushita. As with all FastData branded product you get a full 30-day money back satisfaction guarantee. Shown is the VGA color.

FastData Boards
- 9600B SendFax w/ 2400B Modem ... 79
- 9600B Send Receive Fax w/2400B ... 99
- Ethernet 16bit 10Base-T ... 109
- IDE 16 Bit 1:1 Hard Floppy Disk Cont ... 29
- IDE HD FD w Par 2 Serial Game ... 39
- Parallel 2 Serial Game Card ... 29
- RLL 16bit 1:1 Hard/Floppy Disk Cont. ... 59
- XT 1.44 Dual Floppy Controller ... 35

FastData 2400 Baud Modem $49

The FastData 2400 baud internal modem is fully Hayes compatible and can be configured to COM port 1-4. It has an internal speaker, is auto answer & auto dial and comes with communications software.

FastData Monitors
- 14" Amber or White Monochrome ... 99
- 14" White VGA Monochrome ... 119
- 14" CGA Color 52 dot pitch ... 199
- 14" Super VGA 1024 x 768i 28 dp ... 299
- 14" Non-Int VGA 1024 x 768 28 dp ... 369

VIDEO & MONITORS

ATI
- Graphics Vantage 1mb ... 389
- VGA Basic 16 Integra ... 75/129
- VGA Wonder XL 256K / 1mb ... 169/229
- 8514 Ultra 8514+VGA 1mb ... 599

Diamond
- SpeedStar Plus HiColor 1mb ... 175
- Stealth VRAM HiColor 1mb ... 265

Everex EGA 480 Card ... 69

FastData Monitors & Cards ... see above

Hercules Graphic Card + ... Call

MAG Colorview/15 ... Call

Mitsubishi
- 1410 EGA ... 325
- Diamond Scan 1381 ... 499
- Diamond Scan 16L ... 919

NEC
- Multisync 3FGX ... 599
- Multisync 4FG ... 749
- Multisync 5FG ... 1299

Orchid
- ProDesigner II 1mb ... 219
- Farenheit 1280s HiColor ... 319

Panasonic C1381 VGA ... 329

Seiko CM1440 /CM1450 ... 489/569

Sony 1304 Multiscan ... 599

Video 7
- VGA 1024i 256K / 512K ... 119/139
- V-RAM II VGA 512K / 1mb ... 249/319

Zenith 1492 ... 599

PRINTERS

Canon
- BJ10XE Portable ... 319
- BJ300 / BJ330 Ink Jet ... 459/599
- LBP-4 Laser ... 799

Citizen
- 200GX 9 Pin ... 159
- GSX 130 24 Pin ... 249
- GSX140+ 24 Pin ... 295
- GSX145 24 Pin Wide ... 395
- PN48 Std Pro ... 299/329

Epson ... Call

Memory Products
- HP II, IIP, or III 1/2mb Upgrade ... 99/129
- OKI 400 1/2mb Upgrade ... 129/189
- Pana 4420, 4450i 1/2mb Upg ... 119/169

NEC
- P3200 24 Pin ... 239
- P3300 24 Pin Wide ... 339
- P6200/6300 ... 419/59
- Colormate PS ... 4599
- Silentwriter 2 Model 90 ... 1495

Okidata
- Okilaser 400 ... 669

Panasonic 4420 Laser $699

Who says affordable laser printers have to be stripped? Not with the Panasonic 4420. It prints at a fast 8 pages per minute, includes a large 250 sheet paper tray and comes with 22 standard fonts. It works with all current major software programs and has 512K of upgradable memory.

Panasonic
- KXP1180 9 Pin ... 149
- KXP1123 24 Pin ... 199
- KXP1124i 24 Pin ... 279
- KXP1624 24 Pin Wide ... 339
- KXP1695 ... 369
- KXP2624 24 Pin Quiet ... 399
- KXP4420 Laser ... 699
- KXP4450i Laser ... 1069
- KXP4455 Laser ... 1699

QMS PS410 ... 1699

Seiko
- Smart Label Printer Plus ... 167

Star
- NX1001 ... 139
- NX2410 / 2415 ... 189/369
- XB2410 / 2415 ... 419/539

Texas Instruments
- Microlaser PS17 ... 1199
- Microlaser PS35 ... 1499
- Microlaser XL PS35 ... 2899

FastData 286/12 $699

Imagine a fast 286 computer at a super price and you've got the FastData 286/12. This system is complete, not stripped. You get one megabyte of zero-wait-state memory and a 28ms IDE hard disk - standard. Also included is an amber monitor and graphics card, your choice of a high density 1.2mb or 1.44mb floppy drive and a Key Tronic keyboard. And since its a FastData, you are backed with toll-free technical support, one year warranty with the FastShip replacement program & on-site service plan, and our 30 day full money back satisfaction guarantee!

- ✓ 12mhz 80286 processor.
- ✓ 1 megabyte RAM.
- ✓ 40 mb 28ms IDE hard disk 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add $59)
- ✓ Standard chassis (shown)
- ✓ Five drive bays.
- ✓ 200 watt power supply.
- ✓ Math coprocessor socket
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock calendar, parallel port, game port, & 2 serial ports.
- ✓ Key Tronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ MS-DOS 5.0.
- ✓ Full documentation.
- ✓ FCC Class B.

286/12	40mb	80mb	100mb	200mb
Mono	$699	$829	$899	$1,149
Mono VGA	$799	$929	$999	$1,249
VGA Color	$949	$1,078	$1,149	$1,399
VGA 1024i	$999	$1,129	$1,199	$1,449

FASTMICRO Software 1-800-441-FAST

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Clanon Personal Developer	45
Clanon Professional Developer 3.0	449
Clipper 5.01	489
DataEase	509
dBase III+	419
dBase IV	449
dBXL Diamond	129
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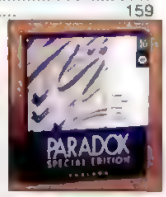
Paradox Competitive Upgrade	165
Paradox SE	65
Per:Form Designer & Filler	89
Personal Rbase	79
Q & A 4.0	249
RapidFile	99
Rbase for DOS	447
Reflex	159

Paradox SE $79



New Paradox Se is a special version of the award-winning database management software designed specifically for small business and home use. Just enter your data and Paradox SE lets you query, sort, even write reports and form letters. Easy to use and learn, you can create multi-table data-entry applications without programming

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Simcity	28
SimEarth	39
Wing Commander I / II	39 / 45

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Bannermania	21
Express Publisher	Call
Microsoft Publisher for Windows	129
Pagemaker 4.0	489

Microsoft Publisher $129

New Microsoft Publisher for Windows gives you easy-to-use page layout, text, and graphics tools to create publications quickly. It includes a built-in word processor with speller or import text from any major word processor. Also includes PageWizards - step by step publication creation, WordArt - text special effects, and Toolbar - access to fequently use functions are a click away. Also comes with 100+ clip art images, border art, drawing tools & more

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Pacioli 2000	29
Peachtree Crystal Acctg. Windows	175
Peachtree Complete III	139
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PC Tools 7.1 is the perfect set of utilities for DOS 5 Includes new application menu system, remote operation of another PC advanced data recovery and an enhanced Backup in DOS and Windows versions. Also included is the award-winning Dos Shell and Backup and new Windows utilities

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Works w/ MS Serial Mouse	149

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Borland C++	289
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Quick C or Quick Pascal	60
Visual Basic for Windows	125
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Lotus 1-2-3 2.3 $325

The powerful spreadsheet that runs on any PC New WYSIWYG display mouse support, 200 graph types, drawing tools and other graphics features to make spreadsheet publishing a breeze Release 2.3 also adds auto compress printing, auditor, file viewer, context sensitive help, print preview and more. Call us for upgrade information too!

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Quattro Pro 3.0 Comp. Upgrade	89
Quattro Pro 3.0 SE	47
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Publisher's PowerPak / WordPerfect	45

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WordPerfect is the #1 rated word processing software Its got almost every feature imaginable and yet it is easy to use The current version adds pull-down menus, mouse support, table creation and equation editor. Add this to the best software support in the business and you can't go wrong!

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WordPerfect 5 1	239
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WordPerfect Office	89
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Writer's Toolkit	79

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Control Room	69

MS-DOS 5.0 Upgrade $55

The new Microsoft DOS 5 0 frees 45K or more for DOS on 286 & 386 PC's. It includes a new Shell, Undelete and Unformat, new Editor and more. Also includes Qbasic, Command Line Help, new Backup and Windows enhancements. Plus, you can install it on your drive without reformatting, even on Networks. This official upgrade pack requires that you simply have an older command.com on your drive!

CoreFast	60
Carbon Copy Plus	107
Desqview 2.4	75
Desqview 386 2.4/6.0	125
Direct Access	57
Disk Manager Dos / Novell	36 / 95
Disk Optimizer	29
DR DOS 6.0	65
GoScript 3.0	89
Fastback Plus	114
HiJaak 2.0	95
InfoSpotter	45
Labels Unlimited	45
Laplink Pro	89
Microsoft Learning DOS	32
MS-DOS 5.0 Upgrade	55
Norton AntiVirus	79
Norton Backup	90
Norton Commander	90
Norton Utilities 6 0	109
PC Anywhere IV	95
PC Tools Deluxe 7.1	99

LapLink Pro $89

In addition to fastest and easiest laptop to PC or PC to PC file transfers, new LapLink Pro ends the hassles of modem file transfers too! Its remote install feature allows you to transfer files to a PC without LapLink Pro Includes parallel & serial transfer cables

Personal Lawyer	34
P.D. Queue	55
PFS.Preface	47
Pop Drop Plus	53
PrintRite	19
ProComm Plus	65
Prodigy	25
QA Plus	85
QEMM 386 6 0	57
QRAM 2.0	49
SideKick 2 0	53
Sideways	55
Smartcom Exec	69
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Super PC Kwik	43
Virex-PC	75
XTree Gold 2 0	89

WINDOWS SOFTWARE

3-D Charts to Go for Windows	55
ACCPAC Simply Acctg for Windows	119
Adobe Illustrator	299
Adobe Streamline	119
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Adobe Type Manager Plus Pack	115
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Ami Pro 2 0	279
Ami Pro 2 0 Competitive Upgrade	89
Asymetrix Toolbook	279

Windows 3.0 $89

Get in on the Windows revolution! Windows turns your 286 or above into a powerful multitasking workstation that runs even non Windows applications. Includes many integrated applications standard Plus if you buy Windows from FastMicro we'll throw in 12 of the best Windows shareware programs free!

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Microsoft Ent Pack I, II or III	27
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Microsoft Productivity Pack	39
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Microsoft Word for Windows	299
M Y O B	129
Norton Backup	85
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Microsoft Office $447

This special bundle includes the leading Windows applications, Excel, Word and PowerPoint all in one Excel is the tops rated graphical spreadsheet, Word is the #1 selling Windows word processor and PowerPoint is the top presentation package Act now and you will save half the cost if purchased separately

BeckerTools Plus	77
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Corel Draw 2.0	359
Correct Grammar	57
Current	119
DBfast/Windows	239
DynaComm 3 0 Async.	139
Excel	299
FaceLift	57
Form Publisher	139
Freehand	Call
Grammatik IV for Windows	55
HDC First Apps or Windows Express	55

Microsoft Works $129

New Microsoft Works for Windows is the easy-to-use integrated software for Windows that's designed with small business users in mind It includes a Word Processor with Speller and Thesaurus, Spreadsheet with charting, Database with report generator and Drawing toolsto design graphics you can paste into your word processing document On line help is a click away and WorksWizards guides you through the process of creating custom documents

Microsoft Excel or Word Upgrades $129 ea

Upgrade from the Spreadsheet or Word Processor you're using now to the award wining Excel or Word for Windows Excel 3 0 is the leading spreadsheet for Windows and includes Toolbar™, which simplifies many tasks to the click of a mouse New Word for Windows 2 0 adds many new features to the top selling Windows word processor To upgrade, you must fax us the the title page from WordPerfect 1 2 3 or other qualifying software

Instant Orgchart!	119
JustWrite	129
Lotus 1-2-3 for Windows	379
Lotus 1-2-3 Competitive Upgrade	89
Persuasion	319
Per:Form Pro	179
PFS WindowWorks	119
Pro Write Plus	159
Project for Windows	429
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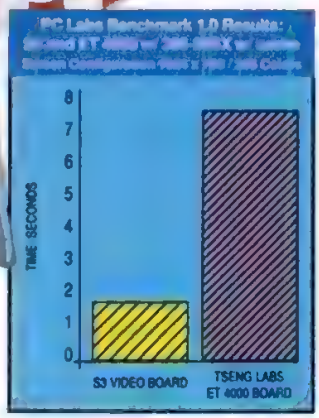

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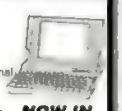

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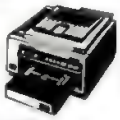

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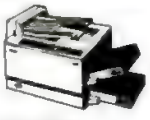

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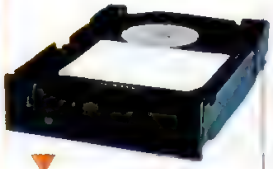

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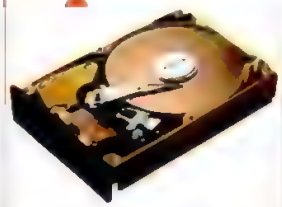

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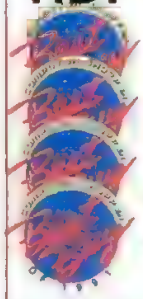

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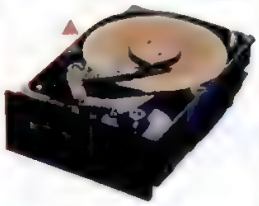

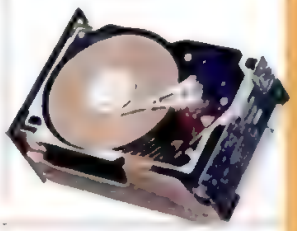

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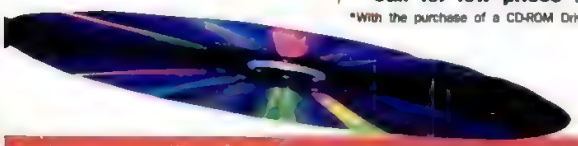

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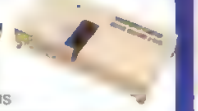

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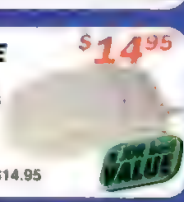

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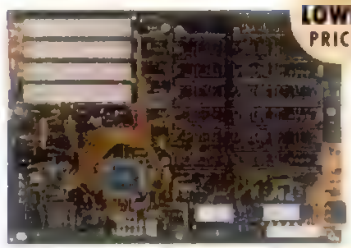

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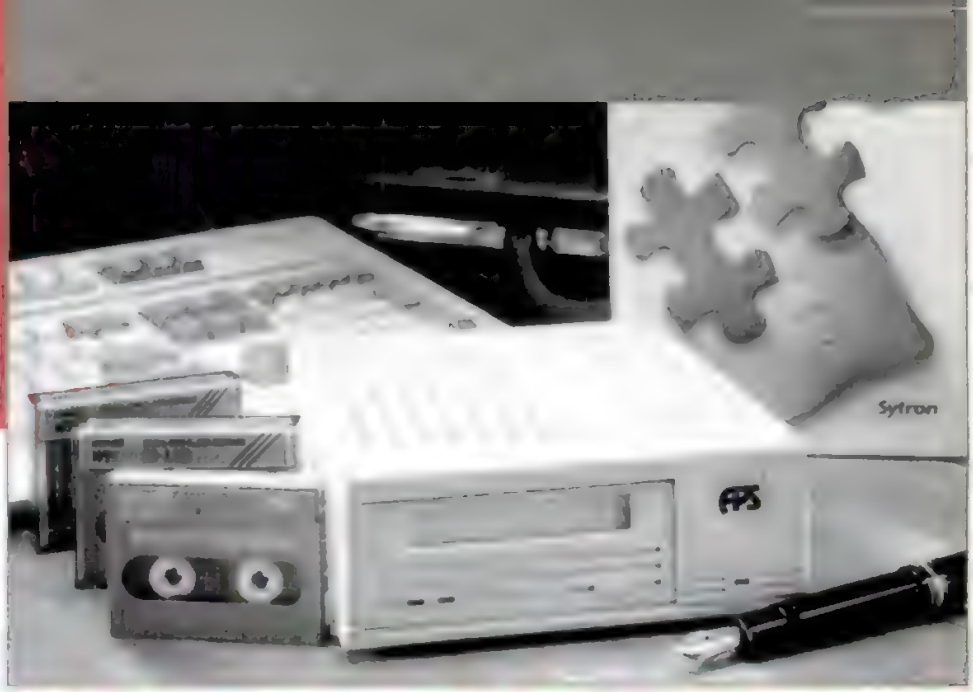

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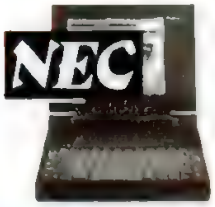

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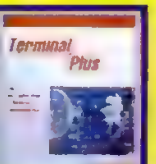

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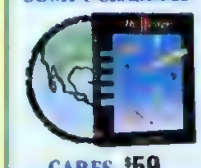

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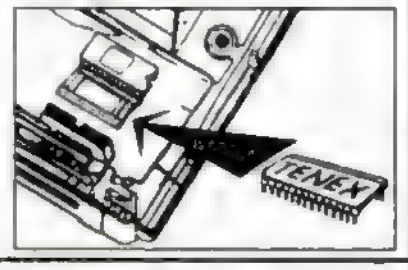

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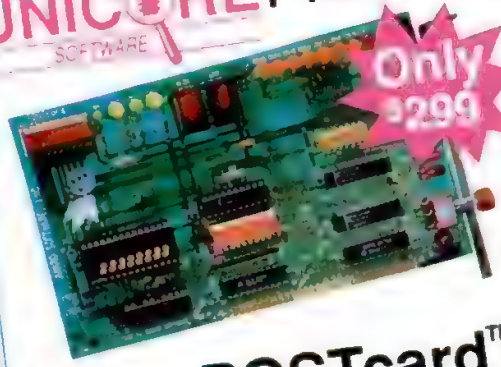

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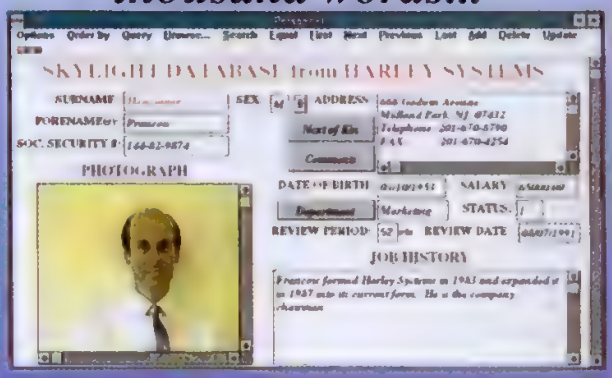

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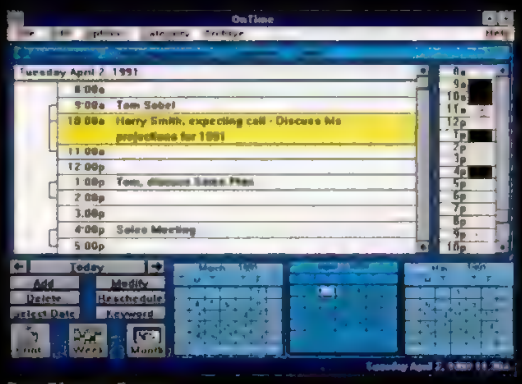

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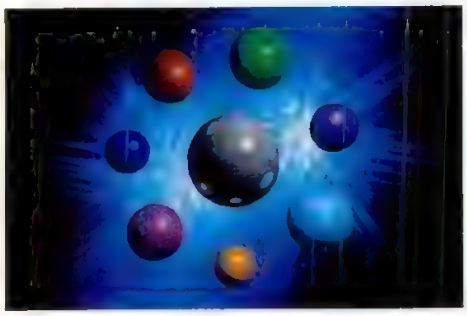

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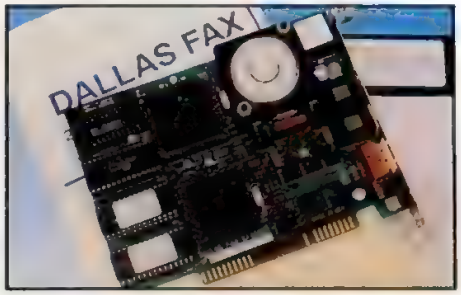

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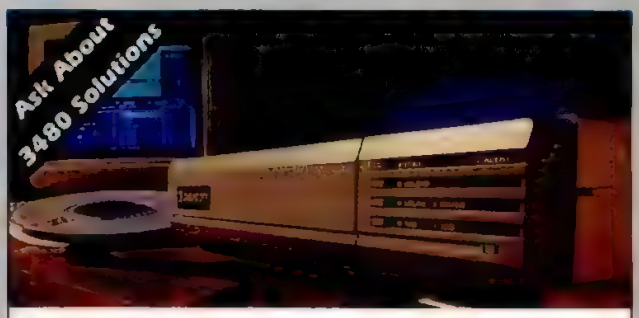

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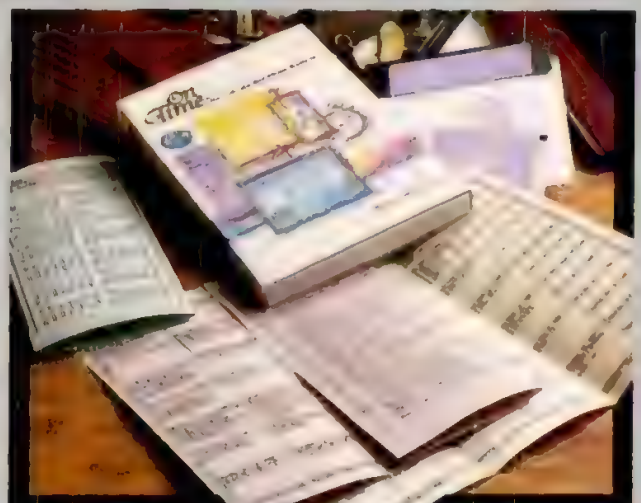

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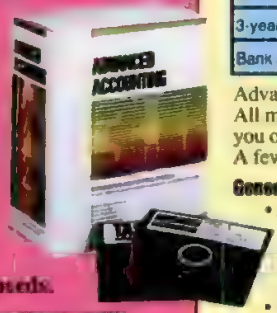

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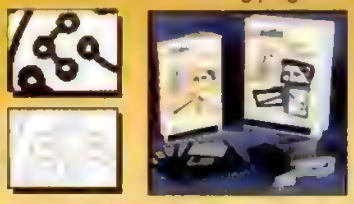

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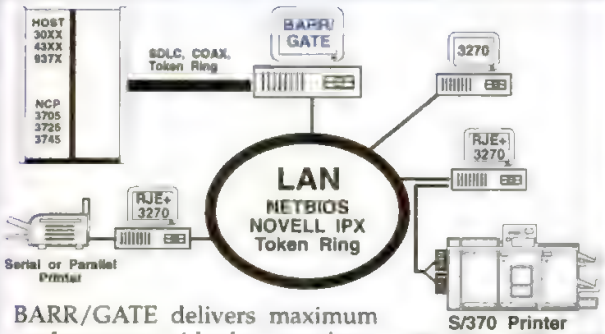

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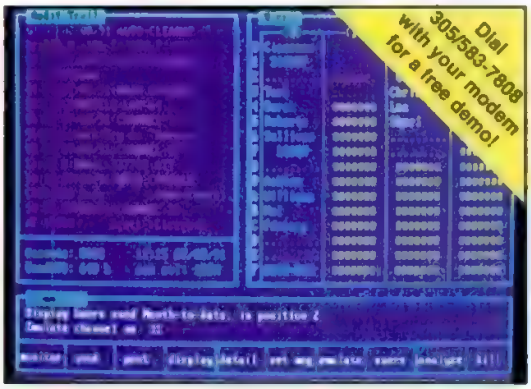

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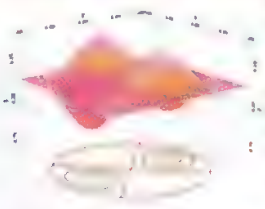

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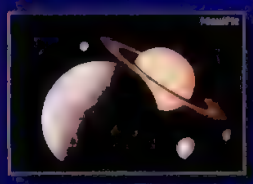

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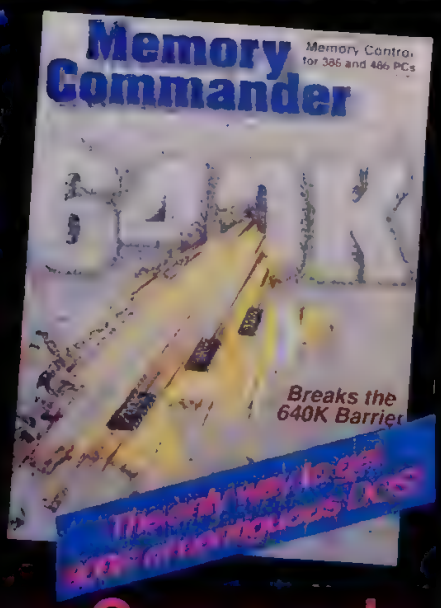

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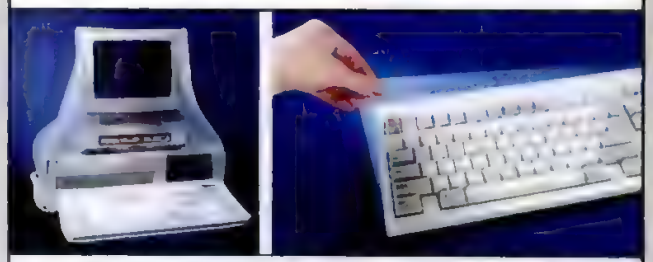

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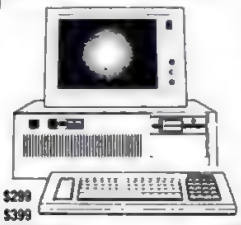

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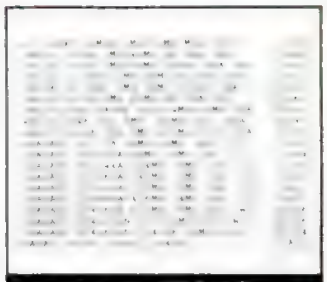

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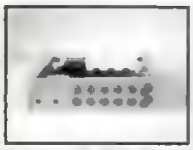

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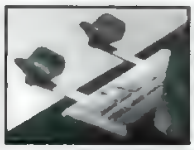

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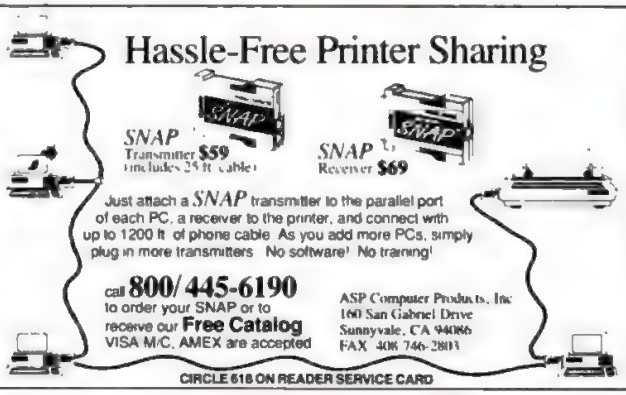

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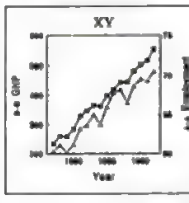

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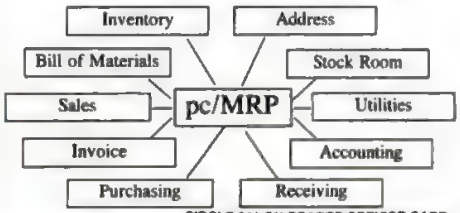

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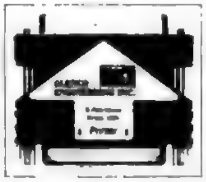

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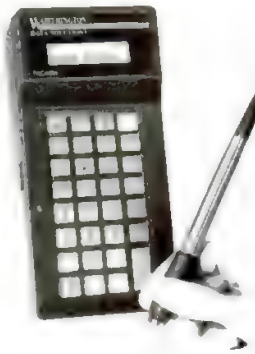

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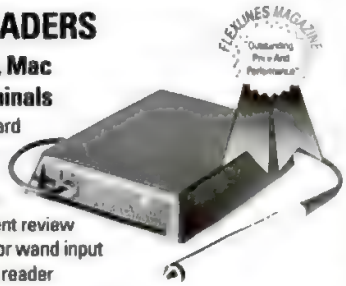

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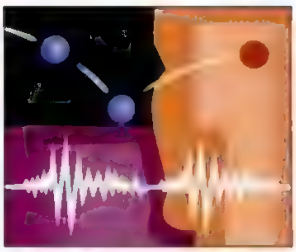
Coming Up

■ MULTIMEDIA



The buzzword in 1992 is *multimedia*, but just what is it and what do you use it for? *PC Magazine* attempts to pin down the products that take computing one step beyond by creating an interactive environment that merges state-of-the-art video and digital audio technology with text and graphics. We'll also look at the tools that are available to make this all happen, and what multimedia may mean to your future.

■ MULTIMEDIA PCs AND UPGRADE KITS

The manufacturers of multimedia upgrade kits and PCs are making promises worth talking about: The thrill of stereo sound and music as well as text and graphics animation, all combined in one desktop package. But should you believe the hype? PC Magazine Labs provides in-depth reviews of multimedia PCs, upgrade kits, and all the hardware that makes multimedia tick.

■ MIDI SEQUENCING SOFTWARE

These days, MIDI software isn't just for musicians. Anyone preparing a multimedia application or presentation needs to consider how music will fit into the project. PC Magazine Labs evaluates five MIDI sequencing packages that let you edit prerecorded tracks to fit your needs or make your own kind of music from scratch.

■ MULTIMEDIA AUTHORING SYSTEMS

Is the information kiosk—a system allowing public access to information consisting of text, graphics, sound and video—a part of our future? The answer depends partly on the quality of the tools that will be available for building the applications. We look at three packages that are designed to help you build interactive multimedia presentations.

■ MULTIUSER DATABASES

No one argues the notion that you can save hundreds of thousands of dollars by converting widely dispersed database applications from a minicomputer to a PC-based LAN. The questions that remain concern performance: Will the network be brought to its knees? Will users end up fighting for access to the records they need? A major evaluation of nine multiuser databases should put an end to those questions.

■ NETWORKING: THE ESSENTIAL TRUTHS

In this special feature, Workgroup Systems Editor Frank J. Derfler, Jr. discusses the alternatives, techniques, and tricks to networking, including how to share printers, communications links, files, and operations. He doesn't pull any punches, praising and slamming products and technologies while helping you avoid the black holes of networking. ■

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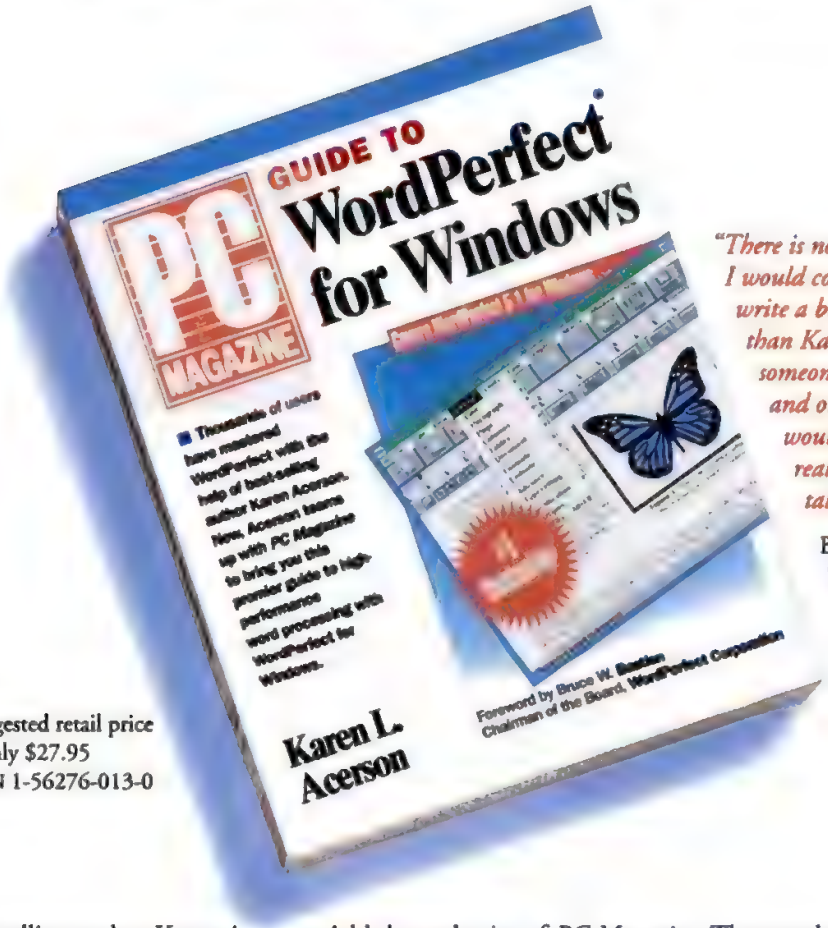

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After Hours

Products for the Leisure Side of Personal Computing

Booting (Up) Your Lawyer—Desktop Legal Aid

LEGAL SOFTWARE
by Kent H. Roberts

Law affects nearly every aspect of our daily life. But due to the way the law is created and enforced, the average American can have trouble understanding its requirements, and it usually costs too much to go to a lawyer for advice.

Several software products offer inexpensive legal assistance. These programs presume that with a good orientation and a proper set of "forms" (prototype legal documents with blanks for the specifics of the individual transaction), any intelligent person can be his or her own lawyer.

Recent updates of two products provide an interesting indication of the limits of this belief and the future direction of consumer legal software.

Version 2.0 of *Hyatt Legal Services Home Lawyer* ($79.95) maintains its focus on "the 16 documents Americans most often need." These documents include wills, promissory notes, a residential lease, employment and credit-related documents, and various powers of attorney.

The new release of *Home Lawyer* is a significant advance over the prior version, which distributor MECA Software now dismisses (along with the bulk of consumer legal software) as a mere "fill-in-the-blank form generator." (Version 1.0 was reviewed in our last roundup of legal software, After Hours, August 1990.)

While forms are the heart of any legal software, the most important part of any consumer legal product is the mechanism for directing the user to the right form. This mechanism is incomplete without some way of guiding you through the important decisions you must make to complete the appropriate form. It is this "front-end" portion of *Home Lawyer* that has been completely and effectively renovated.

Users working with *Home Lawyer* must first complete a "Preventive Law Interview" by answering a series of questions in pop-up dialog boxes. Based on your answers, a personal legal "audit" is assembled. This audit directs you to the most relevant portions of the on-line legal encyclopedia—"Personal Law Topics."

An "Estate Planning Worksheet" (completed in the same manner) helps you identify the issues that you must address in preparing a Last Will and Testament.

The Personal Law Topics include clear but basic discussions of such areas as "Wills and Trusts," "Owning Your Own Home," "Divorce and Custody," "Your Job or Business," "Your Credit," "Going to Court," and "When You Need a Lawyer." The topics within the encyclopedia can be perused either on-screen or in the manual.

As with the Preventive Law Interview, the forms themselves are also completed through dialog boxes. It is genuinely charming to work through each form's questionnaire and see the assembled document. The final documents can be printed with *Home Lawyer*'s built-in printer utility. Or, if you don't like what you see, *Home Lawyer* permits you to shell from the program to your DOS- or Windows-based word processor. From there, you can retrieve the document as a text file and modify it as you desire.

Home Lawyer's 16 forms are good, conservative documents for the most part. No program can address all of the decisions that a person must make, but Hyatt Legal Services seems to be moving closer to the limits of what is possible.

The best evidence of how precise this format can get is *Home Lawyer*'s new living will—the directive to physicians regarding ending life-support systems once a person has slipped into a coma. Users simply enter their home state to access one of 42 available state-approved forms.

Unfortunately, the authors of *Home Lawyer* still do not completely trust the user's abilities. For example, Hyatt lawyers have apparently had bad experiences with co-executors in wills; therefore, you are not allowed to designate co-executors in yours. A simple warning rather than a flat prohibition would be more consistent with the basic premise of consumer legal software.

Miami lawyer Lawrence Pino distinguishes his software, *The Desktop Lawyer*, Version 3.0, ($139.95) from other legal software packages by its breadth. *The Desktop Lawyer* contains over 300 legal forms covering a wide range of business, consumer, and personal transactions. These include establishing various types of business organizations; the purchase and sale of goods, land, and businesses; leases; wills; employment; borrowing and lending; and real estate management and construction.

Pino's three megabytes of legal forms ship in three for-

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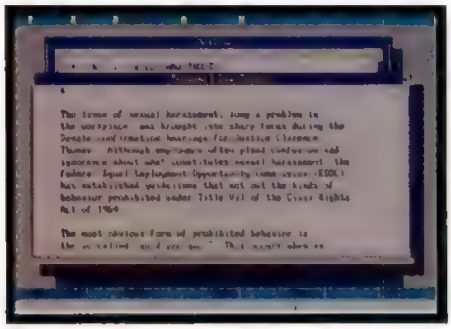


***Home Lawyer*'s on-line essay on sexual harassment, inspired by the Clarence Thomas hearings, is an extremely useful combination of sound legal advice and common sense.**

LEGAL SOFTWARE
The Desktop Lawyer **brings more than 300 legal documents to your favorite word processor.**

It's Legal **combines legal know-how with a friendly windowing environment.**

Legal Partner: **Lawyer-in-a-box for small businesses.**

ENTERTAINMENT
Romance of the Three Kingdoms II: **Learn the venerable arts of chivalry and diplomacy as you lead an army and rule a kingdom in ancient China.**

Booting (Up) Your Lawyer

CONTINUED

mats—*WordPerfect* 4.2 or later, *Microsoft Word* 3.0 or better for the Macintosh, and ASCII files for use in all other DOS-based word processors.

To use *The Desktop Lawyer*, you select the legal form you want, pull it up in your favorite word processor, make any necessary modifications, and then print it out.

To aid you in the selection process, *The Desktop Lawyer*'s Reference Manual contains 43 checklists of information. These lists set forth basic legal considerations for selected transactions (such as the purchase or sale of real estate, durable power of attorney, and filing articles of incorporation) with suggestions on the appropriate forms and lengthy articles on basic business law, the court system, and wills and trusts.

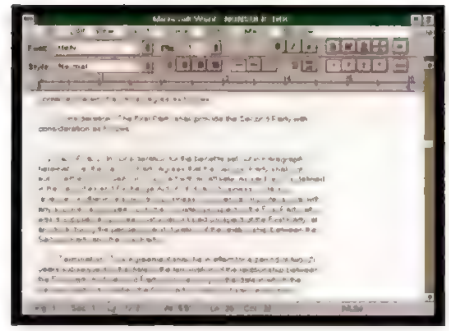
Version 3.0 of *The Desktop Lawyer* includes minor modifications that make the product more accessible. However, the core features of *The Desktop Lawyer* have not been changed much; they are still inadequate.

Both the user orientation features and the forms need much more work. The checklists do not provide a comprehensive directory to the forms. Worse, little effort is made to identify any of the choices within each document that the user must make. Based upon reading the checklists and document summaries, you might think that all you have to do is fill in the blanks. And while *The Desktop Lawyer*'s forms are generally far more advanced than those in *Home Lawyer*, the quality of forms is variable and uneven.

With some work, the forms in *The Desktop Lawyer* can be made to be as sophisticated and reliable as they need to be. The catch-22 is that legal training is probably required to fine-tune them. It's hard to get excited about a consumer product with that limitation.

Ultimately, the faith of these software developers in the ability of everyday Americans to meet their own legal needs is justified. *Home Lawyer* is still basic in content, but Version 2.0 is a major step toward actually providing affordable access to the law. If anything, the authors of *The Desktop Lawyer* show greater faith in the consumer's legal abilities, but the product ultimately fails to provide users with the tools necessary to represent themselves.

List Price: *Hyatt Legal Services Home Lawyer*, Version 2.0, $79.95. **Requires:** 512K RAM, hard disk, DOS 2.0 or later.



The forms in *The Desktop Lawyer* are filled with legal jargon; some contain dangerous ambiguities. You use the provided forms in your favorite word processor—in this case, *Word for Windows*.

Mouse supported. MECA Software Inc., 55 Walls Dr., Fairfield, CT 06430; 800-288-6322.

CIRCLE 518 ON READER SERVICE CARD

List Price: *The Desktop Lawyer*, Version 3.0, $139.95. **Requires:** PC word processing program. Supports *WordPerfect* 4.2 or later directly, ASCII for other DOS-based word processors. The Open University, 24 South Orange Ave., P.O. Box 1511, Orlando, FL 32802; 800-874-0388.

CIRCLE 519 ON READER SERVICE CARD

LEGAL SOFTWARE: Satisfying, but Is It Practical?

There seems to be a trend in the software industry to introduce similar forms-generating packages to answer a perceived need for simple, low-cost legal work. These packages can be helpful, but from an attorney's perspective, such software should not be used without consulting a competent, flesh-and-blood attorney. You wouldn't trust your health to a software package, would you?

You can rest assured that these software companies have included pages full of disclaimers, disavowing their responsibility to keep you up-to-date with any changes in the law that might affect you. CommonTouch's *Legal Partner*, Parsons Technology's *It's Legal*, and Pino's *The Desktop Lawyer* all caution you against using homemade, legally binding documents without first discussing them with your attorney.

Still, there are worthwhile consequences to this trend toward legal populism. For one thing, more and more individuals are demanding to know how the law works. Furthermore, personal legal software can be used to set up your basic document, which you can then run by your lawyer to make sure it's legally sufficient. Hopefully, your efforts up front will reduce the time spent with an attorney, thereby saving you some of the legal fees painfully associated with consulting your lawyer.

—*Bernard Yee* ■

PC Esq.—Personal Legal Service from the Desktop

LEGAL SOFTWARE by Bernard Yee

It's Legal and *Legal Partner* are two do-it-yourself "legal document" software packages. *It's Legal* is designed for personal use, and *Legal Partner* is geared more toward small businesses. Both packages purport to be able to create documents such as binding contracts when you input certain information.

Version 2.0 of *It's Legal* from Parsons Technology ($69) follows the format of other Parsons software packages: Text-based windowing software with several options. *It's Legal* stands out for the associated functions in its windowing system, such as a notepad, glossary, calculator, and amortizer. The Documents option allows you to generate legal documents for personal or small-business use.

Overall, the documents created by *It's Legal* are good, basic instruments that can save your attorney time while they save you money. To satisfy a small business's needs, *It's Legal* lets you create employment documents—formal offers and conditions of employment, letters of acceptance, and consulting agreements. What you have at stake here is probably of considerably less importance than your estate and family, so these documents can be used with confidence and they should prove to be quite useful in practice. *It's Legal* also contains options to create promissory notes and leases.

It's Legal is at its best with documents such as consumer letters, including complaints, letters challenging credit ratings, and demand letters. These documents do not require legal expertise and will be welcome in most households. Still, if you want a promissory note to contain specific language, like acceleration clauses, you'll proba-

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PC Esq.

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bly have to consult your lawyer.

The wills are the most problematic aspect of *It's Legal*. Living wills involve your right to die in certain situations, and they can be affected by cutting-edge law. Similarly, a will, even a "simple will," as Parsons calls it, is an incredibly complex document with many subtle tax and family considerations.

Too many difficulties arise from an improperly drafted will, and any lawyer would be suspicious of a program that purported to be able to create a will in such a way that it would follow all the formalisms applicable in each state. In fact, *It's Legal* sagely advises people with an anticipated estate of more than $450,000 to seek an attorney's advice, but anyone with any estate should speak to an attorney in all probate matters.

Understandably *Legal Partner*, the $95 personal legal software package from CommonTouch, specifically states that it does not "do" wills, as they are too complicated to adopt a "form-filling" approach to document generation. Although wills generated from software look legal, they should only be used as a starting point for a lawyer-drafted will.

Both *It's Legal* and *Legal Partner* can be used to create powers of attorney, which empower other individuals to act on your behalf in various capacities. Once again, *Legal Partner* eschews durable powers of attorney in the estate context for the same reasons it doesn't cover wills. However, both *It's Legal* and *Legal Partner* can draft documents creating general and limited powers of attorney. *Legal Partner* also has promissory notes, but (predictably) says that you should consult an attorney for leases due to the potential complexity of the lease.

The documents generated by *Legal Partner* proudly use "legalese" (as does *It's Legal*)—that bizarre Anglo-Latin that confuses laymen. Unfortunately, legalese is really more of a necessity than you may believe, since many of the cases interpreting contracts specifically refer to such language. Law, being extremely risk-averse, opts to use that tried-and-true phraseology.

Legal Partner was written by a professor and students at an unnamed law school, and its background shows. The documents are thorough and impressive, and the manual is comprehensive and helpful in explaining the workings of the system. Documents such as trade-secret confidentiality agreements, indemnification agreements, license of patents and copyrights, and lien releases presuppose a good sense of their legal usage. *Legal Partner* has context-sensitive help, but there is no written explanation of each individual document. The software seems to be targeted for more sophisticated business users and will probably prove more daunting for the inexperienced layperson.

It's Legal's best feature is a smooth, functional Windows-like interface that makes calculations and note-taking easy.

For less experienced users, *It's Legal* features a sophisticated but user-friendly windowing interface and helpful side options. It contains a condensed version of Black's Law Dictionary—an on-line glossary with pithy definitions of the terminology invariably associated with law.

Ultimately, both *It's Legal* and *Legal Partner* take away some of the mysticism from legal documents. And when properly used, both packages afford the individual or small-business user the ability to generate useful documents. By teaching you the importance of such documents and the steps involved in preparing them, *It's Legal* and *Legal Partner* will help you discuss these documents with your lawyer more intelligently. And that might prove to be the biggest plus of all.

List Price: *It's Legal*, Version 2.0, $69.00. **Requires:** 512K RAM, hard disk or two 360K floppy disk drives, DOS 2.11 or later. Parsons Technology, 1 Parsons Dr., Post Office Box 0100, Hiawatha, Iowa 52233; 800-223-6925, 319-395-7314.
CIRCLE 520 ON READER SERVICE CARD

List Price: *Legal Partner*, $95.00. **Requires:** 320K RAM, hard disk or two 360K floppy disk drives, DOS 2.1 or later. CommonTouch Inc., Post Office Box 21, Newton, MA 02159; 800-762-6789, 617-964-7740.
CIRCLE 521 ON READER SERVICE CARD

Kent H. Roberts is an attorney with the law firm of Brill, Sinex, and Stephenson in Dallas, Texas. Bernard Yee is a New York City attorney with the firm of Donovan, Leisure, Newton, and Irvine. The opinions printed here are those of Mr. Roberts and Mr. Yee alone. They do not represent the opinions of their respective firms.

Though lacking in frills, *Legal Partner* shows a thoughtful and professional approach to document generation.

Intrigue, Strategy, and Scheming: Waging War for Ancient China

ENTERTAINMENT
by Barry Brenesal

You've fought legions of undead, fire-wielding demons, and battalions of alien battle cruisers. Now, get ready for the ultimate Dark Challenge.

In each of the six available role-playing scenarios in KOEI's *Romance of the Three Kingdoms II* ($69.95), you choose one of three to five characters rated for their war skill, intelligence, charisma, holdings, and general trust to be your regional leader. These traits, your relationships with other rulers, and hidden factors (like virtue and duty) establish your own persona and those of all computer-driven figures—including 350 individual Chinese generals, whose support is crucial to your success.

No two characters are alike, and it is very difficult to determine how anyone in *Romance of the Three Kingdoms II* will react until the chips are down. A quiet descendent of some ancient family may suddenly declare autonomy in the province you entrusted to him. Another who valiantly trained your troops may be waiting for the first bribe to jump sides during a battle. Optimistic and pessimistic assessments of your cohorts are offered by a pair of wandering sages (who probably make a good living at this, given the tangled loyalties of this game).

But turnabout is fair play: Other leaders are susceptible to the same kind of treatment. You can try convincing two rivals that each is plotting against the other and use various techniques to steal another ruler's best and

CONTINUES

Romance of The Three Kingdoms II

CONTINUED

brightest. Plant one of your own generals in a neighboring province, wait until he gets hired by your opponent, and then bring him back over to your side during wartime. Sneakiness isn't attractive, but in *Romance of the Three Kingdoms II*, it's a necessary trait for survival.

When you aren't engaged in the fine art of diplomacy, KOEI's latest simulation provides insights into the complexities of resource distribution. Each of your generals can perform one action a month, but most generals have very limited skills—making your choice that much more important. That short, crafty general: Should he try to buy one of Cao Cao's men or concentrate on raising the loyalty of his province's private citizenry? Is that smiling warrior better occupied with training recruits, spying on enemies, or bearing a gift to some distant magistrate. . .and just whose neck does he have in mind while he fingers his sword hilt?

The abstract nature of battle in KOEI products continues to resemble chess or checkers far more than realistic war simulations. But an increased variety of weather and terrain, "smarter" algorithms among opposing generals, the bribery option, and the uncertainty of alliances (for instance, whether a requested third party will come to your aid, hold back, or even offer generals and men to your enemy) makes war in *Romance* the most challenging KOEI has yet devised.

Romance uses high-resolution EGA with a conservative but attractive color scheme and beautifully detailed line drawings. Music makes its KOEI debut in this simulation: Pleasantly scored melodies representing different Chinese states are played at appropriate moments during peace and wartime, either through your PC's speaker or the supported Ad Lib sound board. You can save an endless number of games to floppy or hard disk at three levels of difficulty, and no two games are ever alike.

As you've no doubt realized, this isn't an easy simulation to win. Machiavelli wouldn't have lasted a month with this crowd. Nonetheless, it's an easy one to enjoy and quite as addictive as KOEI's *Bandit Kings of Ancient China* (After Hours, September 1, 1990). With attractive graphics, distinctive characters, ever-fresh situations, and charming music, *Romance of the Three Kingdoms II* is a welcome addition to the gaming scene. ■

List Price: *Romance of the Three Kingdoms II*, $69.95.
Requires: 640K RAM, DOS 2.1 or later, CGA or better monitor.
KOEI Corp., 1 Bay Plaza, #540, 1350 Bayshore Hwy., Burlingame, CA 94010; 415-348-0500.

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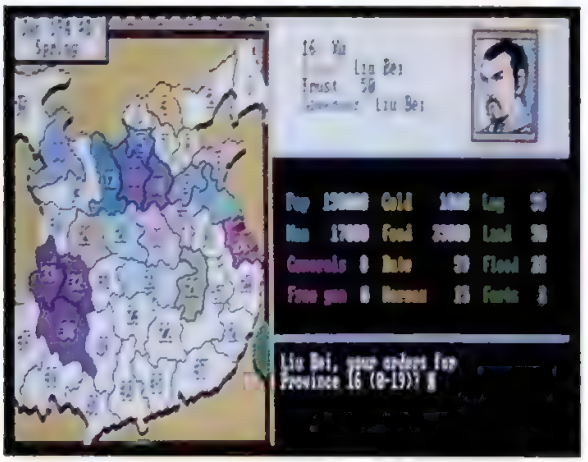

A ranking for trust is included for the characters in *Romance of the Three Kingdoms II*, as intrigue and deceit play large roles in this simulation.

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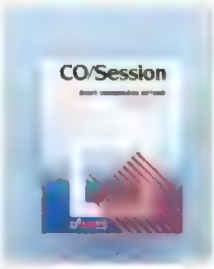

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

And in the Computer Simulation for Stud Horse of the Century, It Was Man o' War Followed by Native Dancer, with Warren Beatty Finishing a Surprise Third

Hawthorne Race Course in Illinois paid an Illinois Institute of Technology grad student $12,000 to write software simulating a stakes race matching the greatest thoroughbred horses of the twentieth century. Winner of the 1¼-mile race: Secretariat (by less than a length), followed by Man o' War, Kelso, Citation, Spectacular Bid, Forego, Swaps, Count Fleet, Native Dancer, Ruffian, Dr. Fager, and Colin.

This Must Be the Version Running Under Windows

"In order to design the new [satellite] dish, a program in Turtle C has been written on one of the [Chinese University of Hong Kong's] 80386-based personal computers."

—*South China Morning Post*, August 13, 1991

Press Releases We Never Quite Finished Reading

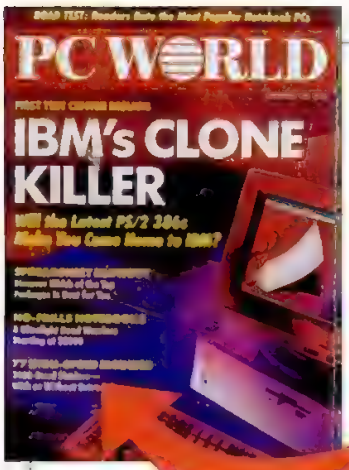
"The question most asked last week at the Self-Insured Institute Conference in Orlando was, 'What claims processing system is available today that can take us into the future, and how much will it cost? . . .' "

—ProSystems press release

Classified Intelligence

Amstrad Computer PCW8256 with printer, not compatible with anything. $125. 12609 Deasau Rd. xxx-xxxx.

—*Austin* (Texas) *American-Statesman*, July 28, 1991



Maybe that's the case for *PC World*'s easygoing readers (September 1991), but to us, "high-speed modems" means 9,600 bps and up—not "2,400 baud."

CARTOON: RICHARD TENNANT

Amazing Facts

"Apple MacIntosh [sic] and IBM computers are compatible, so either system can operate with the other's software."

—*Daily News*, Woodland Hills, California, August 13, 1991

"DOS 5 . . . also contains an 'unformat' tool, which can restore data from a disk that has been accidentally misplaced."

—Computer Consumer column, *Binghamton* (N.Y.) *Press & Sun-Bulletin*, July 29, 1991

"Although the CD-ROMs we'll be talking about record digitally, the disk manufacturing is the same as the process for making analog audio CDs."

—*Computer Graphics World*, August 1991

"Analysts say Stratus, founded in 1980, made several decisions early on that have proved to be instrumental in its success. It stuck with fault-tolerant computers, designed to keep working even if no parts fail . . ."

—*Boston Globe*, August 4, 1991

We're Not Sure We Understood What He Said, but It Sure Sounds like IBM

"IBM assistant general manager of programming [Lee] Reiswig said Microsoft was spreading fear, uncertainty and doubt (FUD) among users [about whether IBM will include Windows capabilities in future versions of OS/2]. 'I think they're trying to FUD up our ability to run Windows applications, but we don't need their help to do it.' "

—*PC Week*, August 19, 1991

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a PC Magazine *T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: David Coniam (Turtle C), Bill Thomison (Amstrad Computer), Scott Bee (high-speed 2400 baud), Robert Wilson (Mac-IBM compatibility), Alan Jewell (DOS 5 unformat), Jerry Beck (analog CDs), Richard Phillips (fault-tolerant), James Collins (FUD).*

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   ☐ i386™SX-based systems ☐ UNIX® based systems
   ☐ i386-based systems ☐ Notebooks
   ☐ i486™SX-based systems ☐ Other: _____
   ☐ i486-based systems
2. Are you interested in computer products for:
   ☐ Home ☐ Business ☐ Resale
3. If for resale, please identify your primary customers:
   ☐ General Business ☐ Government ☐ Education ☐ Medical
4. How many PCs does your company plan to purchase in the next twelve months?

Quantity	Timeframe	Quantity	Timeframe
_____	Less than 1 month	_____	6-12 months
_____	1-3 months	_____	More than 12 months
_____	3-6 months		

5. What do you plan to use computer products for?

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6. How many PCs do you have installed now at your company?

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7. Are you interested in leasing? ☐ Yes ☐ No

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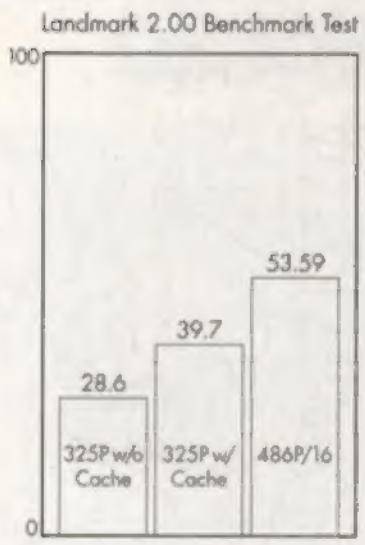

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